"ASSOCIATION OF AORTIC KNOB CALCIFICATION WITH INTRACRANIAL STENOSIS IN ISCHEMIC STROKE PATIENTS IN TERTIARY CARE CENTRE"

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DEPARTMENT OF GENERAL MEDICINE

KILPAUK MEDICAL COLLEGE, CHENNAI

THE TAMIL NADU DR.M.G.R.MEDICAL UNIVERSITY

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CERTIFICATE

This is to certify that this dissertation entitled **"ASSOCIATION OF AORTIC KNOB CALCIFICATION WITH INTRACRANIAL STENOSIS IN ISCHEMIC STROKE PATIENTS IN TERTIARY CARE CENTRE"** submitted by Dr.P.ARUNPRABU to the faculty of General Medicine, The Tamil Nadu Dr.M.G.R Medical University, Tamilnadu, Chennai in partial fulfilment of the requirement for the award of M.D degree Branch I (General Medicine) is a bonafide research work carried out by him under my direct supervision and guidance.

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DECLARATION

I, Dr.P.ARUN PRABU, solemnly declare that Dissertation titled **"ASSOCIATION OF AORTIC KNOB CALCIFICATION WITH INTRACRANIAL STENOSIS IN ISCHEMIC STROKE PATIENTS INTERTIARY CARE CENTRE"** is a bonafide work done by me at Government Royapettah Hospital / Kilpauk Medical College, Chennai, during April 2017 to September 2017 under the guidance and supervision of Prof.Dr.P.Paranthaman, M.D.,FRCP, Professor of Medicine, Government Royapettah Hospital,, Chennai. I also declare that this bonafide work or a part of this work was not submitted by me or any other for award degree or diploma to any other university, board either in India or abroad.

This dissertation is submitted to the Tamilnadu DR. M.G.R Medical University, towards the partial fulfilment of requirement for the award of M.D. Degree (Branch – I) in General Medicine.

Place : Chennai Signature of the candidate

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INSTITUTIONAL ETHICS COMMITTEE
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Protocol ID. No.03/2017 Meeting held on 17.04.2017

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "**Association of Aortic Knob Calcification with Intracranial Stenosis in Ischemic Stroke Patients in Tertiary care Centre**" submitted by Dr.P.Arun Prabu, M.D. (General Medicine), PG Student, GKMC, Chennai-10

The Proposal is APPROVED

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

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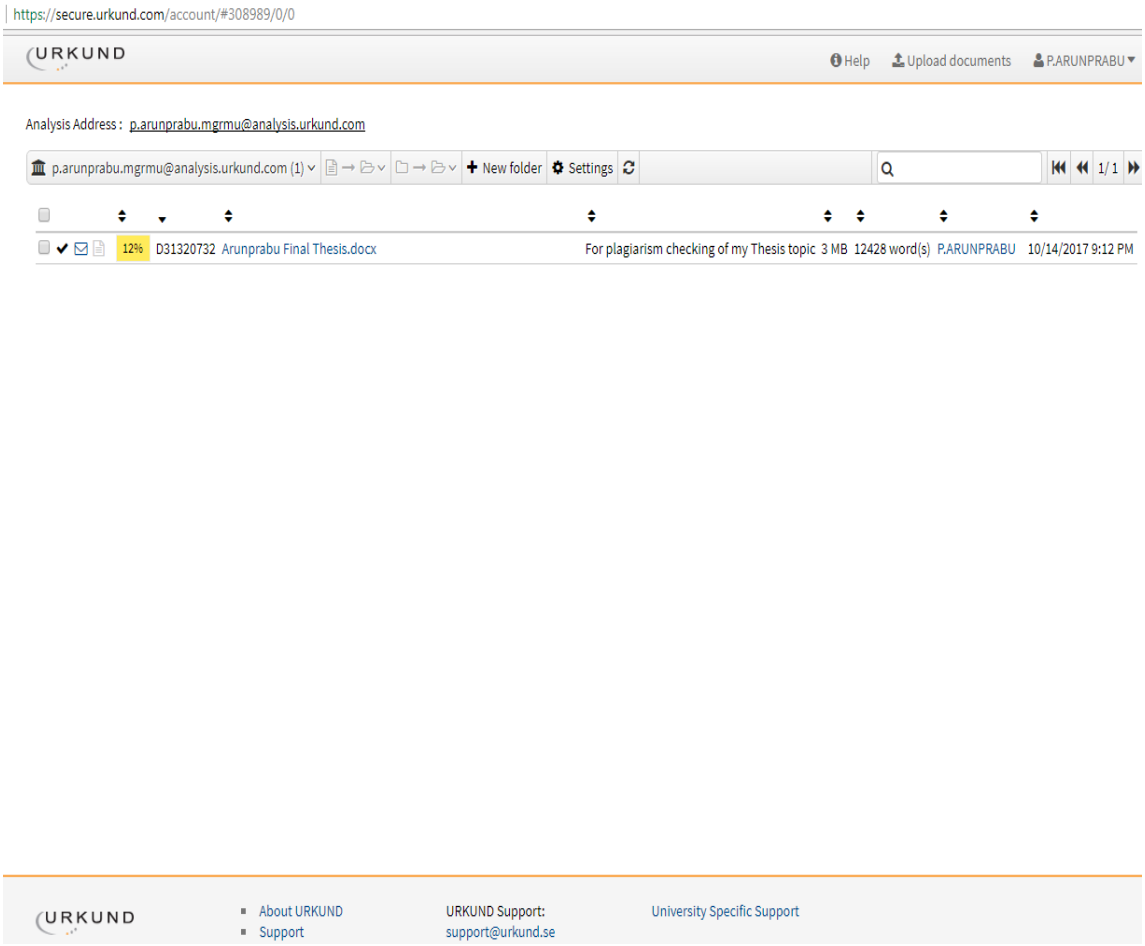
PLAGIARISM CERTIFICATE



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Date: **Signature of the Candidate**

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ABBREVIATIONS

ICS	**-**	**INTRACRANIAL STENOSIS**
AC	**-**	**AORTIC KNOB CALCIFICATION**
CVA	**-**	**CEREBROVASCULAR ACCIDENT**
TIA	**-**	**TRANSIENT ISCHEMIC ATTACK**
TGL	**-**	**TRIGLYCERIDES**
HDL	**-**	**HIGH DENSITY LIPOPROTEIN**
LDL	**-**	**LOW DENSITY LIPOPROTEIN**
MCA	**-**	**MIDDLE CEREBRAL ARTERY**
MRI	**-**	**MAGNETIC RESONANCE IMAGING**
CT	**-**	**COMPUTED TOMOGRAPHY**
CoW	**-**	**CIRCLE OF WILLIS**
rtPA	**-**	**TISSUE PLASMINOGEN ACTIVATOR**

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INTRODUCTION

In the arterial bed, Deposition of calcium may indicate the extent of atherosclerotic lesions and aortic knob calcification (AC) is associated with increased risks of cardiovascular and cerebrovascular events.[11-15] As we know Aortic Knob Calcification associated with coronary artery calcification or carotid atherosclerosis, and might have predictive and prognostic value for coronary artery disease.[11,16,17] Several reports, in addition have shown that aortic knob calcification or aortic atherosclerotic disease is related to ischemic stroke.[14,18,19] Though its clinical significance for CVA ischemic stroke patients with intracranial (IC) stenosis, one of the major mechanisms of ischemic stroke, remains unclear.

Even though digital subtraction angiogramor thoracic computed tomography (CT) are reliable in detecting aortic calcification,[11,20] these imaging modalities are not routinely used. In this study, we evaluated the aortic knob calcification and its clinical importance in ischemic stroke patients with intracranial stenosis and without intracranial stenosis by using simple, non-invasive routine chest radiography.

AIMS OF THE STUDY

AIMS OF THE STUDY

To find the prevalence of Aortic Knob Calcification in Ischemic stroke patients with Intracranial Stenosis in Government Royapettah Hospital/ Government Kilpauk Medical College.

To find the Association of Aortic knob calcification in patients with and without Intracranial stenosis

To evaluate the clinical importance of Aortic knob calcification (AC) in ischemic stroke patients with intracranial (IC) stenosis using simple, non-invasive and routine chest radiography

REVIEW

OF

LITERATURE

REWIEW OF LITERATURE

AORTIC KNOB CALCIFICATION

The aortic knob is visualized as contour of the aortic arch protruding from the mediastinal silhouette on a frontal chest radiograph,the aortic knob is a radiographic structure which is formed by the foreshortened aortic arch and a portion of the descending thoracic aorta. The distance widest point of the ascending aortic knob was measured along with the horizontal line from the point of lateral edge of the trachea to the left of the lateral wall of aortic knob.

Pathologic calcification occurs as a result of abnormal deposits of calcium salts in any tissues except bones and teeth, Dystrophic calcification is characterized as deposition of calcium salts in dead or degenerated tissues with normal calcium levels and normal calcium metabolism. Atheromas in the Aorta and coronaries frequently undergo calcification, it is certain in the atheromas of advanced atherosclerosis associated with intimal injury in the aorta and large arteries. Denatured proteins present in degenerated tissue or necrotic tissue bind phosphate ions, which react with calcium ions to form precipitates of calcium phosphate.

Arterial calcification is a complex, regulated process of biomineralization that resembling osteogenesis, that develops in the intima layer within atherosclerotic plaque, and as suggested, which is a progressive feature of common atherosclerosis. Arterial calcification is strongly associated with atherogenic risk factors such as old age, diabetes, hypertension, cholesterol, or C-reactive protein and with an increased risk of cerebrovascular and

cardiovascular diseases. Calcification and stenosis generally affects people older than age 65. When it occurs in younger people, it's often caused by:

- A heart defect that's present at birth
- Other illnesses, such as kidney failure

There are relatively few causes of calcification of Aorta and Aortic knob as follows

- atherosclerosis
- syphilis
- aortitis
- Takayasu arteritis
- Idiopathic

AORTIC KNOB CALCIFICATION &ACUTE CEREBROVASCULAR ACCIDENT

According to WHO, Stroke is defined as a clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral functioning lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin**.** The word "stroke" is taken in this brief summary to describe damage to the neuraxis (i.e., the brain and spinal cord) resulting from any and all abnormalities in its blood supply. The Neurologic symptoms are usually manifest within seconds because the neurons lack glycogen, so energy failure is rapid. If the cessation of the blood flow lasts for more than a few minutes death of brain tissue or infarction results. When the blood flow is quickly restored brain tissue can recover fully and the patient's symptoms are only transient, this is called a transient ischemic attack (TIA)[4]. A transient ischaemic the effects are temporary, Symptoms may last for a few minutes or up to 24 hours but they should be treated seriously. Most TIAs are caused by a blockage, rather than by bleeding in the brain. Clinical features such as Hemiparesis and aphasia are the commonest. A prospective study has showed 5 years after a single thromboembolic TIA:

- Patient may develop stroke in 30% , a third of these in the first year
- Myocardial infarction for 10% of patients

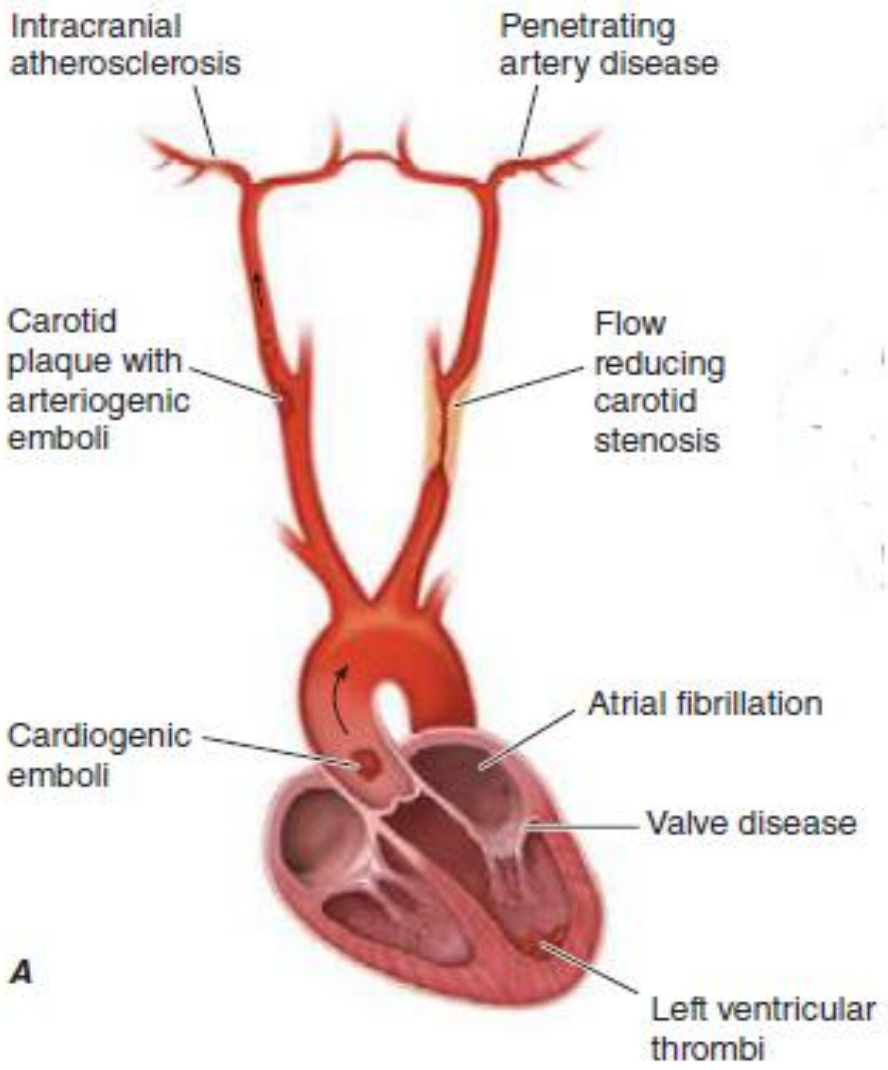
Anterior circulation TIA'S carry more serious prognosis than posterior circulation. Stroke is being the second leading cause of death worldwide, causing 6.2 million deaths in 2011,it is the leading cause of disability.

The incidence of cerebrovascular diseases increases with increasing age, and the number of strokes is projected to increase as the elderly population growsthe death rate following stroke is 20-25%.

There are two main types of strokes[26]:

- ischemic, hemorrhagic and others (arterial dissection, venous sinus thrombosis vasculitis)
- Ischemic strokes are far more common than hemorrhagic strokes.
- Atherosclerosis and Arterial disease is the main pathological process causing Ischemic stroke
- The brain has a blood supply which is fairly consistent between individuals.
- Ischemic strokes can be due to large-vessel atherosclerosis50%[1,6], aortocardioembolism 25%,small-vessel occlusion 25%, other determined causes, and undetermined causes.
- Hemorrhagic strokes are most often due to hypertension but may be caused by specific blood vessel abnormalities and other medical problems.
- There is no reliable way at the bed side to distinguish between haemorrhage and Ischemic stroke
- Haemorrhage more likely tends to have severe headache and coma .
- The clinical impact of a stroke depends largely on the stroke's location in the brain, whether it is ischemic or hemorrhagic, and the size/severity of the stroke itself.

Figure : Multiple Etiology of Cerebrovascular accident



ISCHEMIC STROKE:

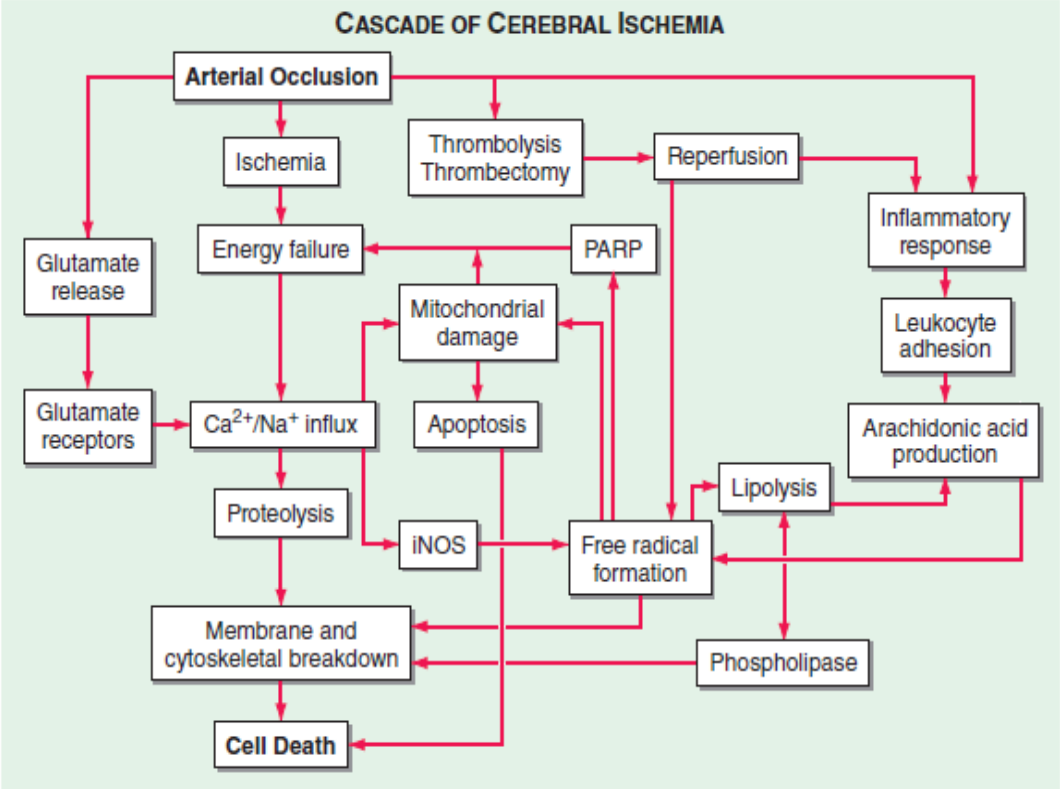
By far, the most common type of stroke is the so-called ischemic stroke or cerebral infarction[1].The brain tissue must be supplied with oxygen, glucose, and other vital materials by the constant inflow of blood in cerebral vessels at a rate of about 50–54 ml of blood per 100 g of brain tissue per minute. Reduction in blood flow to the brain region occurs if there is acute occlusion of an intracranial vessels .

The magnitude of flow reduction is one of the function of collateral blood flow, and this depends on vascular anatomy of the individual which may be altered by disease, the site of occlusion, and systemic blood pressure.

Brain cells which are deprived of adequate blood flow i.e, if the cerebral blood flow [CBF] below 15–20 ml blood flow/100 g tissue/min will become ischemic; their membrane pumps will fail, intracellular processes will begin to break down, and the brain tissue becomes swollen. Importantly, the ischemic brain tissue may still be salvageable if perfusion can be restored at this point of time . If the hypoperfusion worsens (i.e., CBF <8–10 ml/100 g/min) , then this tissue at risk will become irreversibly damaged with cell death proceeding within 4–8 min of hypoperfusion[45,47,48]. This event is referred to as an ischemic stroke.

Depending upon the severity of the ischemia, infarction (cellular death) will occur within few minutes, causing irreversible damage even after if blood flow is restored. This is called the "core" of the infarct. Surrounding the core is tissue which is affected but functionally that may recover if blood flow is restored. This is called as the "ischaemic penumbra". Most of the people will have such an ischaemic penumbra amenable to treatment within the first three hours of the occlusion of the cerebral artery, but many patients may have it up to 12 hours[45,47,48]. This is what described as the so-called "therapeutic window". Thus proper identification of treatable patients is crucial for the efficacy of the interventions and goal for revascularization therapies.

Figure : Showing Cascade of cerebral Ischemia[57]



Focal cerebral infarction occurs via two distinct pathways

- The Necrotic pathway in which cellular cytoskeletal breakdown is too rapid, due principally to energy failure of the cell .
- An apoptotic pathway in where the cells become programmed to die.

Failure of mitochondria to produce ATP due to Ischemia which produces necrosis by starving neurons of glucose and oxygen. Without ATP, functioning of membrane ion pumps stop and neurons depolarize, allowing intracellular calcium to rise. In turn Cellular depolarization also causes glutamate release from distal synaptic terminals; increased and excess extracellular glutamate produces neurotoxicity by increase neuronal calcium influx and activating postsynaptic glutamate receptors. Degradation of membrane lipids and mitochondrial dysfunction from which free

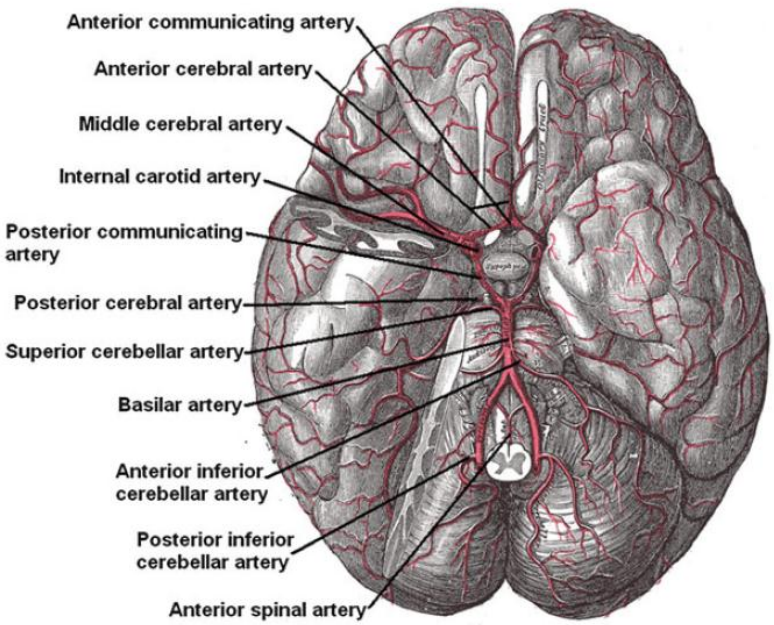
radicals are produced .Free radicals cause catalytic destruction of membranes and damage the other vital functions of cells. Lesser degrees of ischemia, as are seen in the ischemic penumbra, favour apoptotic cellular death allowing cells to die days to weeks later. Fever worsens brain injury during ischemia, as does hyperglycemia (glucose >11.1mmol/L [200 mg/dL]), so it is needed that to suppress fever and preventhyperglycemia as much as possible.

Due to changes in the vessels and parenchyma caused by ischaemia, the flow might not be restored even if the original cause of the obstruction has been removed ("no-reflow phenomenon"). Edema is usually present in all necrotic tissue. In large areas of necrosis, massive oedema might compresses adjacent tissue, which may increases intracranial pressure and might cause herniation of the brain, leading to death within a few days Surgical decompression has been suggested for these cases. The localization of ischaemia and complications experienced by the patient may denote extent of functional disability will depend on the extent and Seizures might occur at the time of stroke occur in 3–5% of infarctions, more often after embolism than thrombosis. The same proportion of patients may develop epilepsy from 6 to 18 months after a stroke. In elderly, Idiopathic epilepsy may be the result of a silent cortical infarction.

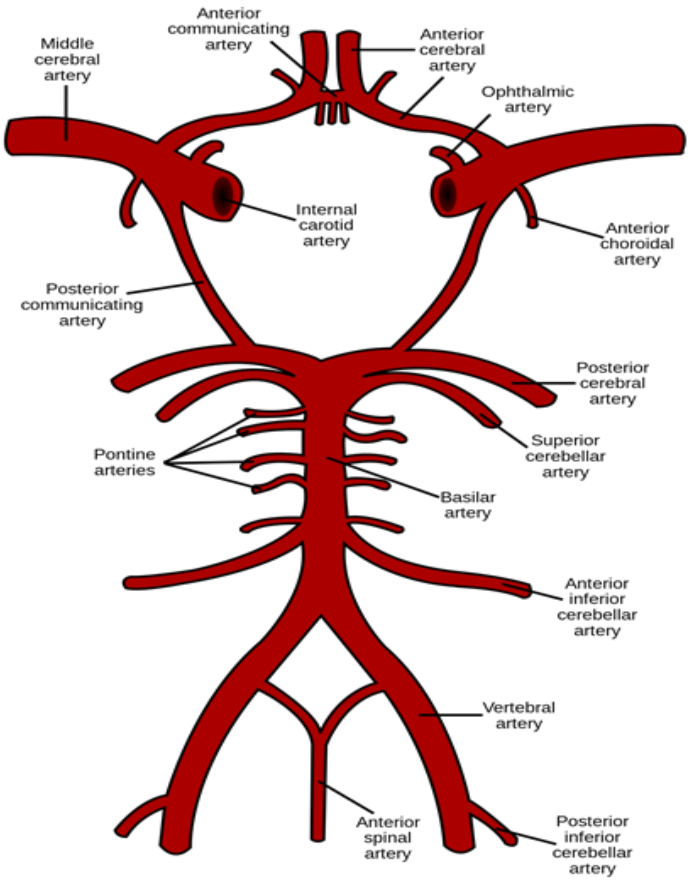
A Review Of Relative Anatomy

All branches of the large brachiocephalic arteries that stem from the aortasupplying blood to the brain. The common carotid arteries on either side ascend the ventral part of and bifurcate around the level of the angle of the mandible, into the external and internal carotid arteries .The external carotid , with the notable exception

of the brain give off branches that supply the structures of the anterior neck and most of the head and face. The internal carotids, by contrast, ascend and enter the skull, and through their intracranial branches perfuse most of anterior 2/3 of the brain, including the entire parietal and frontal lobes and most of the temporal lobes. The so-called anterior circulation is by the internal carotid arteries and their tributaries .The posterior circulation (or vertebrobasilar system) is composed of two arteries, the left and right vertebral arteries, which are branches of the subclavian artery from the aorta. These ascend laterally and dorsally within the vertebral foramen and loop over the C1 vertebra transverse process to enter the skull, ascending the anterior surface of the medulla oblongata as it moves upwards the foramen magnum. The vertebral arteries in turn merge in to the basilar artery at the level of the pons. The basilar artery continues to ascend and bifurcates at the level of the midbrain in to the left and right posterior cerebral arteries. The vertebrobasilar system perfuses the brainstem, cerebellum, occipital lobe, thalamus and part of the temporal lobe. At the base of the skull, shortly after the large arteries enter the cranial cavity, join to form anastomoses to form the so-called Circle of Willis formed by arteries which communicate between the posterior and anterior systems and between the right and left sides of the brain. Distal to the CoW, the cerebral arteries emerge to perfuse the brain: the anterior and middle cerebral arteries From the anterior circulation and the posterior cerebral arteries from the bifurcation at the top of the basilar artery, linked by the anterior and posterior communicating arteries,



Figures Showing Vascular anatomy of Brain(above) and Circle of Willis(below)



RISK FACTORS[30,31,33,34]

There are a number of risk factors that increase the chances of having an ischaemic stroke. Ones that we can't change include[2,3,5,9,28]:

- Age – strokes are more common as we get older
- Ethnicity – strokes are more common in South Asian and African Caribbean people
- Family history of stroke.

A number of medical conditions can increase your risk of stroke including[29]:

- High blood pressure[35] - the biggest risk factor for stroke. High blood pressure can damage the artery walls, contributing to atherosclerosis.
- Atrial fibrillation – a type of fast and irregular heart beat.
- High cholesterol - too much fat in your diet can lead to atherosclerosis.
- Diabetes mellitus

Lifestyle factors can also increase your risk of stroke[42]. They include:

- smoking
- drinking too much alcohol
- eating an unhealthy diet
- being overweight
- lack of exercise.

These lifestyle factors increase the chances of developing the medical conditions described above, and can contribute to damage to your arteries.

CAUSES OF ISCHEMIC STROKE[27]

Thrombosis

- Large-vessel thrombosis
- Lacunar stroke (small vessel)
- Dehydration

Embolic occlusion

- Artery-to-artery
- Carotid bifurcation
- Arterial dissection
- Aortic arch

Cardioembolic

- Atrial fibrillation
- Dilated cardiomyopathy
- Myocardial infarction
- Mural thrombus
- Valvular lesions
- Mitral stenosis
- Bacterial endocarditis
- Mechanical valve

Paradoxical embolus

- Patent foramen ovale
- Atrial septal defect

Stimulant drugs

- cocaine,
- amphetamine

Atrial septal aneurysm

Spontaneous echo contrast

Uncommon Causes

- Venous sinus thrombosis
- Hypercoagulable disorders
- Fibromuscular dysplasia
- Moyamoya disease
- Vasculitis
- Non-inflammatoryvasculopathy
- Cardiogenic
- Subarachnoid hemorrhage vasospasm
- Eclampsia

Stroke Warning Signs

- Sudden weakness or numbness of the face, arm or leg, especially on one side of the body
- Sudden confusion, trouble speaking or understanding
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, loss of balance or coordination
- Sudden, severe headaches with no known cause (for hemorrhagic stroke)

SIGNS & SYMPTOMS

Anterior circulation stroke:

- Paralysis of opposite foot and leg
- A lesser degree of paresis of opposite arm
- Cortical sensory loss over toes, foot, and leg
- Urinary incontinence
- Contralateral grasp reflex, sucking reflex, gegenhalten (paratonic rigidity)
- Abulia (akineticmutism), slowness, delay, intermittent interruption, lack of spontaneity, whispering, reflex distraction to sights and sounds:
- Impairment of gait and stance (gait apraxia)
- Dyspraxia of left limbs, tactile aphasia in left limbs

Middle Cerebral Artery Stroke

- Paralysis of the contralateral face, arm, and leg; sensory impairment over the same area (pinprick, cotton touch, vibration, position, two-point discrimination, stereognosis, tactile localization, barognosis, cutaneographia)

- Motor aphasia-Central aphasia, word deafness, anomia, jargon speech, sensory agraphia, acalculia, alexia, finger agnosia, right-left confusion (the last four comprise the Gerstmann syndrome)
- Conduction aphasia
- Apractagnosia of the nondominant hemisphere, anosognosia, hemiasomatognosia, unilateralneglect, agnosia for the left half of external space, dressing "apraxia," constructional "apraxia," distortion of visual coordinates, inaccurate localization in the half field, impaired ability to judge distance, upside-down reading, visual illusions (e.g., it may appear that another person walks through a table) of topographic memory is usually due to a non-dominant lesion, occasionally to a dominant one
- Homonymous hemianopia ,Paralysis of conjugate gaze to the opposite side

POSTERIOR CIRCULATION STROKE

- Homonymous hemianopia(often upper quadrantic). Bilateral homonymous hemianopia, cortical blindness, awareness or denial of blindness;
- tactile naming, achromatopia (colour blindness), failure to see to-and-fro movements, inability to perceive objects not centrally located, apraxia of ocular movements,
- inability to count or enumerate objects, tendency to run into things that the patient sees and tries to avoid
- Verbal dyslexia without agraphia, colour anomia: Dominant calcarine lesion and posterior part of corpus callosum.
- Memory defect
- Topographic disorientation and prosopagnosia:
- Simultanagnosia, hemivisualneglect,contralateral hemisphere.

- Unformed visual hallucinations, peduncularhallucinosis, metamorphopsia, teleopsia, illusory visual spread, alinopsia, distortion of outlines, central photophobia
- Complex hallucinations
- Central territory. Thalamic syndrome: sensory loss (all modalities), spontaneous pain and dysesthesias, choreoathetosis, intention tremor,spasms of hand, mild hemiparesis: Thalamoperforate syndrome: crossed cerebellar ataxia with ipsilateral third nerve palsy (Claude's syndrome): Dentatothalamic tract and issuing third nerve.
- Weber's syndrome: third nerve palsy and contralateral hemiplegia: Third nerve and cerebral peduncle. Contralateral hemiplegia:cerebral peduncle.
- Paralysis or paresis of vertical eye movement,skew deviation, sluggish pupillary responses to light, slight miosis and ptosis (retraction nystagmus and "tucking" of the eyelids may beassociated): Supranuclearfibers to third nerve, interstitial nucleus of Cajal,nucleus of Darkschewitsch, and posterior commissure.
- Contralateral rhythmic, ataxic action tremor; rhythmic postural or "holding" tremor

PROGNOSIS

The ABCD2 score is a clinical prediction rule used to stratify the risk for stroke in the days following a transient ischemic attack. The ABCD2 score will be based on five parameters such as age, blood pressure, clinical features, duration of transient ischemic attack, and presence of diabetes there is scores for each parameter are added together to produce a result ranging between zero and seven

Table showing ABCD2 Scoring system and points

Age > 60	1 Point
BP > 140 mmHg systolic and/or Diastolic >90mmHg	1 Point
Clinical Features ➢ Unilateral weakness ➢ Isolated speech disturbances ➢ other	 2 Point 1 Point 0
Duration of symptoms ➢ >60 ➢ 10 – 59 ➢ <10	 2 Point 1 Point 0
Diabetes ➢ Present ➢ Absent	 1 Point 0

The risk for stroke can be estimated from the ABCD2 score as follows:

Score 1-3 (low risk)

Score 4-5 (moderate risk)

Score 6–7 (high risk)

National Institutes of Health Stroke Scale(NIHSS) :

The National Institutes of Health Stroke Scale, or NIH Stroke Scale (NIHSS) is a scoring system to objectively quantify the impairment caused by a stroke. The NIHSS is composed of 11 items each scores a specific ability between a 0 and 4. In

each item, a higher score is indicative of some level of impairment, while a score of 0 typically indicates normal function in that specific ability.[1] The individual scores from each item are summed in order to calculate a patient's total NIHSS score. The maximum possible score will be 42, with the minimum score being a 0

Interpretation

Score	**Stroke severity**
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke

The NIHSS has found to be an valid predictor of patient outcomes. A baseline NIHSS score less than 6 indicates a strong probability of a good recovery, while a baseline NIHSS score greater than 16 indicates a strong probability of patient death. On average, an increase in 1 point in a patient's NIHSS score decreases the likelihood of an excellent outcome[50].

IMAGING

To establish the diagnosis as early as possible. Give accurate information about intracranial vasculature and brain perfusion for guidance in selecting the appropriate therapy.

Overview Of Imaging Modalities

- Unenhanced CT

  • Can be performed quickly.

  • Can help identify early signs of stroke, and can help rule out hemorrhage.

- CT angiography can depict intravascularthrombi[52]
- CT perfusion imaging can demonstrate salvageable tissue which is indicated by apenumbra.
- MR Angiography – To evaluate the status of neck and intracranial vessels
- DWI AND PWI - A mismatch between findings on diffusion and perfusion MR images may be used to predict the presence of a penumbra

NECT:

- Widely available.
  - Can be done quickly.
  - It not only can help identify a hemorrhage (a contraindication to thrombolytic therapy),but it also can help detect early-stage acute ischemia by depicting

features such as – 1. THE HYPERDENSE VESSEL SIGN.

2. THE INSULAR RIBBON SIGN.

3. OBSCURATION OF THE LENTIFORM NUCLEUS

Figure : Showing Acute Right Massive MCA infarct

Contrast-enhanced CT scans shows contrast enhancement of subacute infarcts and allow visualization of venous structures. Coupling with multi detector scanners, CT angiography CTA can be performed with IV iodinated contrast making visualization of the cervical and intracranial arteries, intracranial veins, aortic arch, and also the coronary arteries in one imaging session. Intracranial vascular occlusions and Carotid disease are readily identified by this method. After a bolus of contrast IV, deficits in brain perfusion produced by vascular occlusion can be demonstrated which is used to predict the region of infarcted brain and also the brain at risk of further infarction (i.e., the ischemic penumbra). CT imaging is sensitive for detecting SAH (although by itself does not rule it out), and CTA can identify intracranial aneurysms

owing to its speed and wide availability, noncontrast head CT is the imaging modality of choice for patients with acute stroke and CTA and CT perfusion imaging may also be useful and convenient[52,53].

Alberta stroke programme early CT score (ASPECTS)[66]:

The Alberta stroke programme early CT score (ASPECTS) is a 10-point quantitative topographic CT scan score used in subjects with middle cerebral artery (MCA) stroke. ASPECTS was been developed to offer the reliability and utility of the CT examination with a reproducible grading system to detect early ischemic changes on pretreatment CT studies in subjects with acute ischemic stroke of the anterior circulation. Segmental assessment of the MCA vascular territory is usually made and 1 point is deducted from the initial score of 10 for each region involved:

1. caudate
2. putamen
3. internal capsule
4. insular cortex
5. M1: "anterior MCA cortex," corresponding to frontal operculum
6. M2: "MCA cortex lateral to insular ribbon" corresponding to anterior temporal lobe
7. M3: "posterior MCA cortex" corresponding to posterior temporal lobe
8. M4: "anterior MCA territory immediately superior to M1"
9. M5: "lateral MCA territory immediately superior to M2"
10. M6: "posterior MCA territory immediately superior to M3"

An ASPECTS score less than or equal to 7 predicts worse functional outcome at end of 3 months as well as symptomatic haemorrhage.

MRI

The MRI reliably documents the location and extent of infarction in all areas of the brain. It also identifies intracranial hemorrhage and other abnormalities and, using special sequences, might be as sensitive as CT for detecting acute intracerebral hemorrhage.

The following are commonly used MRI techniques:

- T1-weighted imaging (T1-WI) in which cerebrospinal fluid (CSF) will have a low signal intensity in relation to brain tissue
- T2-weighted imaging (T2-WI) in which Cerebrospinal fluid will have a high signal intensity in relation to brain tissue
- Gradient echo imaging, which has the maximum sensitivity in detecting early hemorrhagic changes
- Spin density–weighted imaging in which CSF will have a density similar to brain tissue
- Diffusion-weighted imaging (DWI) reflects the microscopic random motion of water molecules
- Perfusion-weighted imaging (PWI) - hemodynamically weighted MR sequences are read based on passage of MR contrast through brain tissue

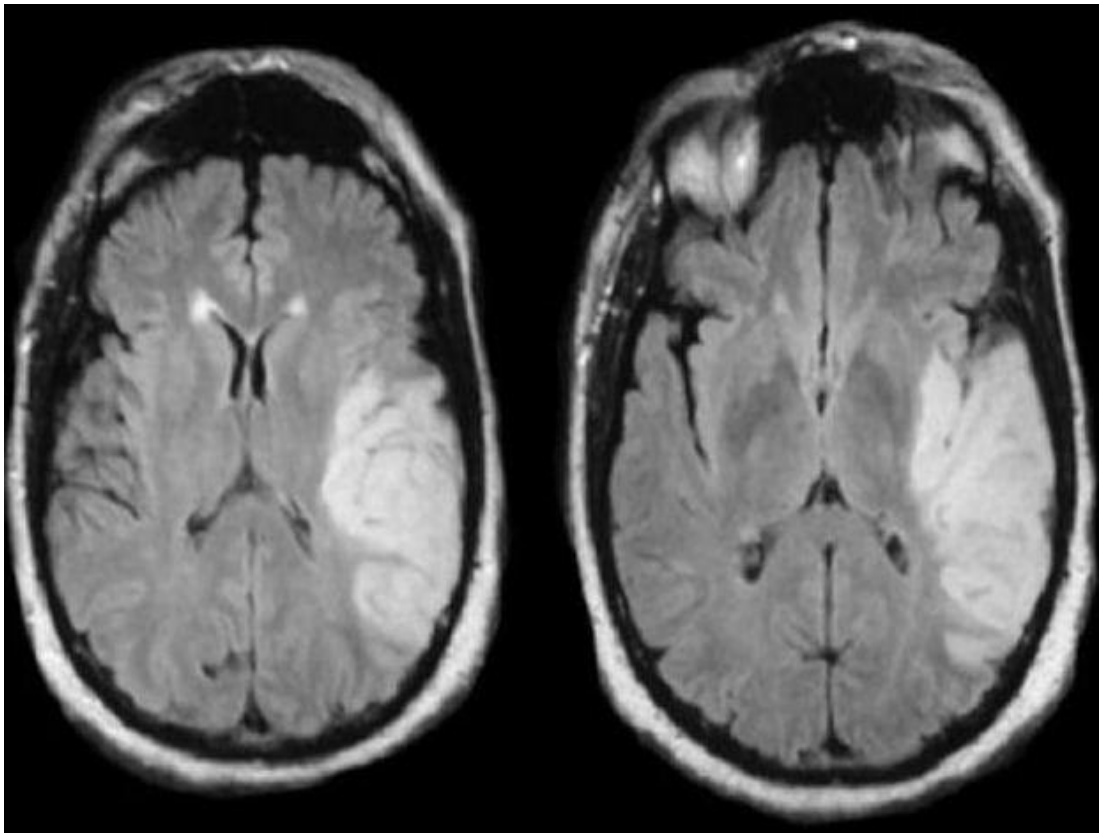


Figure : MRI brain Showing Acute Infarct of Left MCA Territory

MRI with magnets of higher field strength produce more reliable and precise images. Diffusion weighted imaging is easily more sensitive for early brain infarction than standard MR sequences, an equivalent measure of the ischemic penumbra MR perfusion studies can be performed in Brain regions showing poor perfusion but no abnormality on diffusion provide, compared to CT.

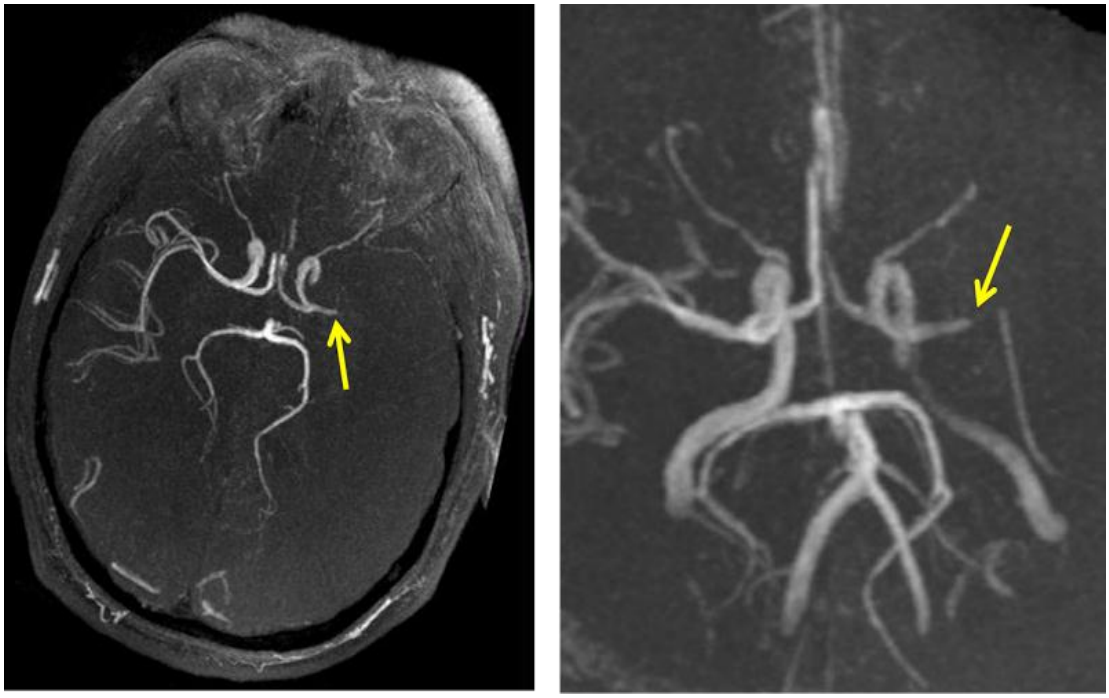


Figure : MRI ANGIOGRAPHY Showing Intracranial stenosis

MR angiography is highly sensitive for stenosisof extracranial internal carotid arteries and of large intracranialvessels[7,10,51].To visualize extra or intracranial arterial dissection MRI with fat saturation is an imaging sequence used. This sensitive technique images clotted blood within the dissected vessel wall. To detect cerebral micro bleeds that may be present in cerebral amyloid angiopathy and other hemorrhagic disorders Iron-sensitive imaging (ISI) is helpful.

Disadvantages:

MRI is expensive and more time consuming than CT and less readily available. The Claustrophobia and logistics of imaging acutely critically ill patients also limit its application. CT being used in most acute stroke protocols because of these limitations.

However, MRI is useful outside the acute period by more clearly defining discriminating new from old regions of brain infarction the extent of tissue injury .MRI brain have a particular utility in subjects with TIA to identify the new infarction, which is a strong predictor of stroke.

Cerebral Angiography

X-ray cerebral angiography is the gold standard for identifying and quantifying atherosclerotic stenosis of the cerebral arteries and for identifying and characterizing other pathologies, and collateral channels of blood flow.

Angiography carries the risks of groin hemorrhage, arterial damage, renal failure and embolic stroke from contrast nephropathy

Ultrasound Techniques

Ultrasonography that combines a B-mode ultrasound image with a Doppler ultrasound assessment of flow velocity useful for Stenosis at the origin of the internal carotid artery and quantified reliably that combines a B-mode ultrasound image with a Doppler ultrasound assessment of flow velocity. For assessment of MCA, ACA, and PCA flow and of vertebrobasilar Transcranial Doppler (TCD) is useful. This technique can detect stenotic lesions in the large intracranial arteries. TCD can assist thrombolysis and improve large artery recanalization following rtPA administration. TCD can detect asymptomatic carotid plaques and microemboli. In many cases, MR angiography combined with carotid and transcranial ultrasound studies eliminates conventional x-ray angiography for evaluating vascular stenosis.

CT angiography of the entire head and neck can be performed during the initial imaging of acute stroke. With this single imaging study the entire arterial

system relevant to stroke, with the exception of the heart, much of the clinician's stroke workup can be completed.

Perfusion Techniques :

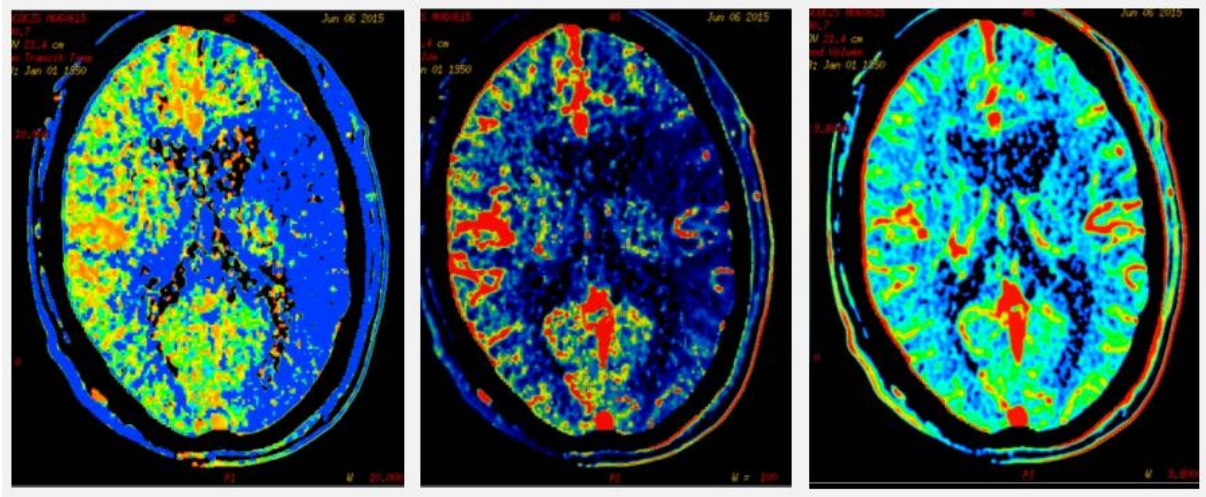


Figure: CT perfusion images showing a large region of hypoperfusion of the left MCA territory

To quantify cerebral blood flow, Both xenon techniques (principally xenon-CT) and positron emission tomography (PET)may be used. These tools can be useful planning for revascularization surgery and for determining the significance of arterial stenosis. Relative cerebral blood flow by Single-photon emission computedtomography (SPECT) and MR perfusion techniques. CT imaging is used as the initial imaging modality for acute stroke, and centers combine both CT perfusion imaging and CT angiography together with the non contrast CT scan. Can measure the ischemic penumbra by CT perfusion imaging which increases the sensitivity for detecting ischemia

MR diffusion imaging can be combined with MR perfusion to identify the ischemic penumbra as the mismatch between these two imaging sequences

MANAGEMENT

- **Prevention[68]:**

Lifestyle modifications, medical and surgical interventions, are available for preventing stroke. Because of their low cost and minimal risk they can be widely applied with some exceptions; others are expensive and carry substantial risk but it may be valuable for high-risk patients. Identification and control of modifiable risk factors, and the total number of strokes could be reduced substantially if especially hypertension is treated which is the best strategy to reduce the burden of stroke.

Others include control Blood glucose by appropriate Oral or Injection hypoglycemic agents, Control of Lipid profile by high dose statins, discouraging smoking and binge Alcohol

Anti-platelet agents are helpful in prevention of atherosclerotic cevents such as TIA and stroke by inhibition of formation of platelet aggregation which is formed due to endothelial injury which induce thrombus formation which can occlude or embolise to distal circulation[58,59]

Aspirin dose of 50-325mg/d is usually recommended for prevention of stroke

Prevent or reverse the brain injury is the first goal of management of acute cerebrovascular accident.

Check Airway breathing and circulation and look for glycemic status and emergency noncontrast CT brain or MRI.

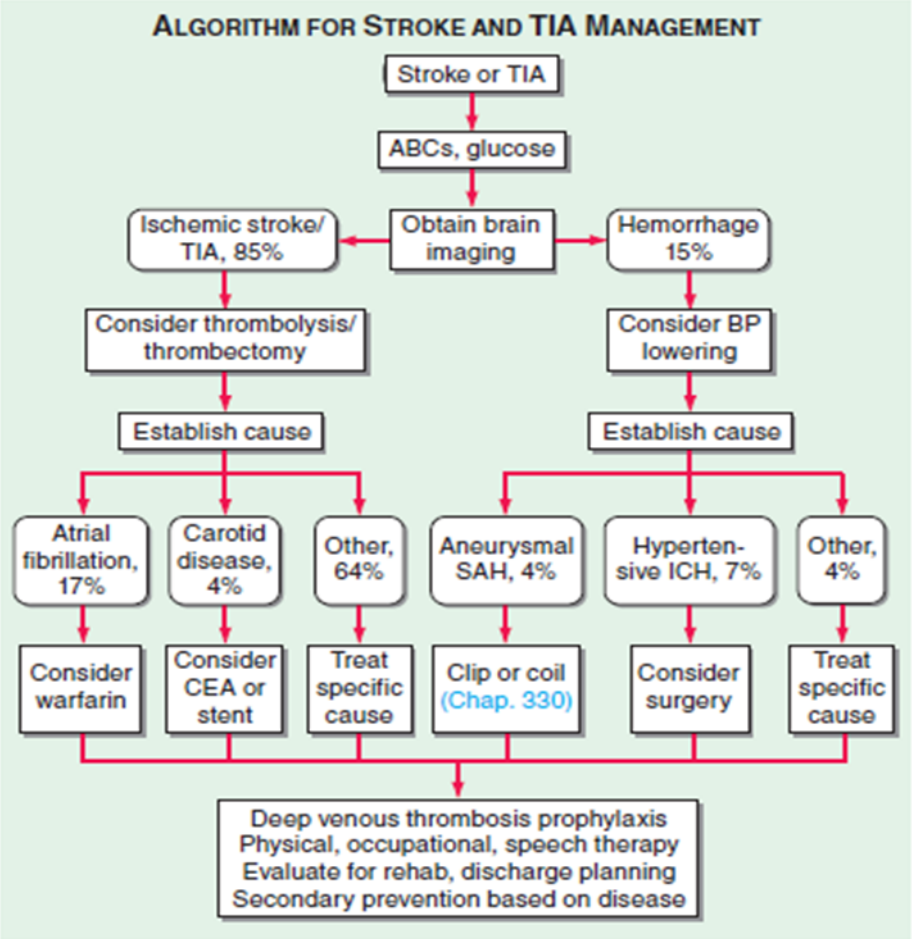


Figure: Algorithm for stroke and TIA management

MEDICAL:

Goal- To optimize cerebral perfusion in the ischemic penumbra

- Blood pressure control &Fever management
- Serum glucose to be maintained <180mg/dl
- Prevention of cerebral oedema – Water restriction and IV Mannitol

INTRAVENOUS THROMBOLYSIS[64]:

- IV- TPA (recombinant tissue plasminogen activator)
- FDA-USA approved Rx of Ischemic Stroke.
- Improved outcome within 3 hours in properly selected patients.
- Results are best within 90 minutes.
- Results are better within 90 -180 minutes.
- TPA reverses ischemic changes saving brain

Inclusion Criteria	**Exclusion Criteria**
1. Within 3 hours of the stroke and patient not needing ventilator. 2. CT Scan head Normal or < 1/3 MCA hypo density 3.Clinical diagnosis of stroke 4.Age of 18 years and above	1. BP > 185/110 mm on admission. 2. Use of Oral Anticoagulants. 3. Major surgery preceding FOURTEEN days. 4. Head injury - LAST THREE MONTHS. 5. Prior Intracranial hemorrhage/Recent GI bleed. 6. Prolonged PT / aPTT / INR / low Platelet count 7.Recent Myocardial infarction 8.Rapidly improving symptoms 9.Platelets <100,00, HCT<25%, Glucose < 50 or > 400mg/dl

- IV rtPA (0.9 mg/kgto a 90-mg maximum; 10% as a bolus, then the remainder over 60 min)

ENDOVASCULAR TECHNIQUES[66,67]:

- **Criteria for Endovascular Therapy:**
  - IA-TPA in selected pts. In < 6 hours due to MCA& BA occlusion
  - Within 6 hours of stroke onset
  - Pre-stroke modified Rankin Score (mRs0-1)
  - Acute ischemic stroke receiving Alteplase (IV r-tPA) within 4.5 hours of onset according to guidelines from professional medical societies (prior administrationof r-tPA is not required)
  - Causative occlusion of the internal carotid artery or proximal Middle Cerebral Artery (M1)
  - Age 18 years or older
  - National Institutes of Health Stroke Scale (NIHSS) score of ≥6
  - Alberta Stroke Program Early Computed Tomography Score (ASPECTS) of ≥6
  - Treatment can be initiated (groin puncture) within 6 hours of symptom onset.
  - In BA occlusion it can be given even after > 12hours.
  - In future IA-TPA will be rewarding.
  - IV &IA(IMS Trial) showed 56% of recanalization

ANTITHROMBOTIC TREATMENT

- Aspirin the only proven effective drug for acute treatment of ischemic stroke
- Clopidogrel may be used to prevention and minor ischemic stroke
- Abciximab increased incidence of intracranial haemorrhage and to be avoided in acute stroke

ANTICOAGULANTS

- No benefit from Heparin in acute ischemic stroke[36]

NEUROPROTECTION

- To prolong the brains tolerance to ischemia
- Drugs blocking excitatory aminoacids
- Hypothermia a neuroprotective treatment in patients with cardiac arrest

REHABILITATION[68]:

- physical therapy
- occupational therapy
- speech and language therapy
- psychology
- chronic care- Educating the complications of immobility e.g DVT

AORTIC KNOB CALCIFICATION & ACUTE CEREBROVASCULAR ACCIDENT

Arterial lesions commence as fatty streaks, progress toraised lesions, and can become complicated by ulceration, calcification, or hemorrhage before occlusion and the development of clinical events such as a myocardial infarction.

This sequence has been well documented, and the presence of raised lesions in young and middle-aged adults is highly associated with abnormal levels of cardiovascular risk factors.

It has also been demonstrated that the arterial wall of the human aorta undergoes progressive accumulation of calcium with aging; the region most affected by these changes is the elastin-rich layer of media and LDL cholesterol in arteries that acts to promote the calcium deposition.

The predominant mineral found in these lesions is apatite, and extracellular vesicles may serves as sites for calcification. In the latter situation, intimal-medial thickening of the carotid artery provides added predictive yield over and above traditional cardiovascular risk factor assessment.

More recently, electron beam computerized tomography has been used to identify and quantify the amount of calcium present in coronary arteries. Greater mineral density has been shown to be highly associated with the presence of clinical coronary artery disease[25], although the specific utility of the newer electron beam technology has not been demonstrated convincingly in population-based prospective studies.

The available evidence on the risks of radiographically identified vascular calcific deposits has generally been focused on the aorta and the coronary arteries.

The presence of calcific deposits in the aortic arch on plain chest radiography has been associated with increased CVD

Arterial calcification is associated with conventional atherogenic risk factors such as old age, diabetes, hypertension, cholesterol, or C-reactive protein and with an increased risk of cardiovascular and cerebrovascular diseases[21,22,23,24]

MATERIALS

AND

METHODS

MATERIALS AND METHODS

STUDY SETTING:

Patient admitted in medicine department of Government Royapettah Hospital / Kilpauk Medical College

ETHICAL APPROVAL:

Institutional ethical committee approval was obtained to conduct the study

STUDY GROUP:

Acute ischemic stroke patients within 7 days of onset, who will be admitted in Medicine department and whom will undergo magnetic resonance angiography at Government Royapettah hospital/ Kilpauk Medical college

STUDY DESIGN :

Cross sectional study.

POPULATION TO BE STUDIED: 102

DURATION OF STUDY: 6 months (APRIL 2017 – SEPTEMBER 2017)

CONSENT :

All the patients were given written informed consent

INCLUSTION CRITERIA:

- Acute ischemic stroke patients within 7 days of onset

EXCLUSION CRITERIA:

- Patients chest X-rays if not properly centered
- Any deviation of the trachea or shift of the mediastinum

- Patients if they had any known disease in the aorta such as aortitis.
- Patients who had cerebrovascular events related to trauma, medical instrumentation, severe concomitant kidney (serum creatinine≥2.0 mg/dL) or liver disease
- Patients with autoimmune disease, moyamoya disease, cerebral vaculitis or embolism from implants, such as an artificial heart valves or atrial fibrillation.

MATERIALS TO BE USED:

- Chest Radiograph Postero- Anterior view
- MRI Angiography Brain
- Blood samples for Total Cholestrol, Triglycerides, HDL, LDL.

METHOD OF COLLECTION OF DATA:

SAMPLE SIZE:

102 cases will be studied

PROTOCOL OF THE STUDY:

- Acute ischemic stroke patients within 7 days of onset
- For every case selected, detailed clinical history associated comorbid illnesses like Diabetes Mellitus, Systemic Hypertension, Hyperlipidemia, Bronchial Asthma, Chronic Kidney disease, Family History of Diabetes Mellitus, Hypertension, geographical area from which patient residing, and results of routine investigations like Complete Blood count, Electrocardiography, X ray chest, Renal function test, Liver Function Test, Urine Routine examination, Blood sugar will be prospectively recorded in the semi-structured proforma. Also In all cases, blood for Fasting Lipid profile will be taken by performing

venipuncture and estimation will be done in Clinical Biochemical Laboratory, Biochemical Department at Govt. Royapettah hospital/ Kilapuk Medical College Chennai

- All the cases undergo chest radiography in the posteroanterior (PA) view. The presence of calcification in the aortic knob is recorded
- All the cases will undergo MRI Angiography of brain
- Based on the findings of the cerebral angiogram, any segment of either intracerebral arteries or extra cranial arteries will be classified as normal, stenosis or occlusion.
- The classifications will be based on a Radiologist report and the existence of any degree of stenotic lesion will be interpreted as stenosis
- Samples will be collected from venous blood after a 12-hour overnight fast, and lipid profiles and standard blood tests will be performed on admission.
- Here I will compare the proportion of Aortic knob calcification in those with Intracranial stenosis and those without Intracranial Stenosis

The following investigations were done to all patients included in the study:

1.Fasting Lipid Profile

Total cholesterol/Triglycerides/HDL/LDL

2.Renal Function test

Sugar

Urea

Creatinine

Electrolytes

3. Liver function test

Total bilirubin

Direct bilirubin

SGOT

SGPT

Alkaline Phosphatase

Total protein and Albumin

4. Complete blood count including Total count, differential count, ESR

5. X-ray chest Postero-anterior view and Electrocardiography.

6.MRI Angiography of brain

CONFLICT OF INTEREST:

NONE

RESULTS

STATISTICAL ANALYSIS

&

DISCUSSION

Data Analysis

The collected data were analysed using IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics, percentage analysis, frequency analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in The Independent groups the Unpaired sample t-test was used. To find the significance in categorical data Chi-Square test was used similarly if the expected cell frequency is less than 5 in 2×2 tables then the Fisher's Exact was used. In all the above mentioned statistical tools the probability value .05 is considered as significant level.

P - Value	** Highly Significant at P ≤ .01
P -Value	# No Significant at P >.05

Population Characteristics:

We conducted the study for the total number of 102 patients out of which 3 subjects were aged less than 50 years (2.9%), 52 subjects were 51-60 years age group (51%), 20 subject were 61-70 years age group(19.6%), 27 subjects belongs to above 70 years(26.5%)Predominant number of patients belong to 51-60 years comes to around 51% of the study. Next major subgroup belongs to more than 70 years of age. Increased age is associated with Intracranial stenosis of mean age of 63 and without intracranial stenosis subjects of 59

Table 2 showing relation of age group vs Intracranial stenosis in which more number of subjects and presence of Intracranial stenosis is maximum in age group within 51-60 years of age with 41 subjects (60.3%), followed by more than 70 year age group with 16 subjects 23.5%, 61-70 years with 11 subjects 16.2%. And Without intracranial stenosis of 8.8% in subjects upto 50 years of age, 32.4% in subjects 51-60 years , 26.5% in subjects 61-70 years of age and 32.4% in subjects of above 70 years

Age –ICS category was analysed using chi-square test and pearson chi-square value is 11.363 and degree of freedom is 3 and p value comes around p-0.010 ($p< 0.05$) which is statistically significant.

Table 1. Age category of the studied population

Age range

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Upto 50 yrs	3	2.9	2.9	2.9
	51 - 60 yrs	52	51.0	51.0	53.9
	61 - 70 yrs	20	19.6	19.6	73.5
	Above 70 yrs	27	26.5	26.5	100.0
	Total	102	100.0	100.0	

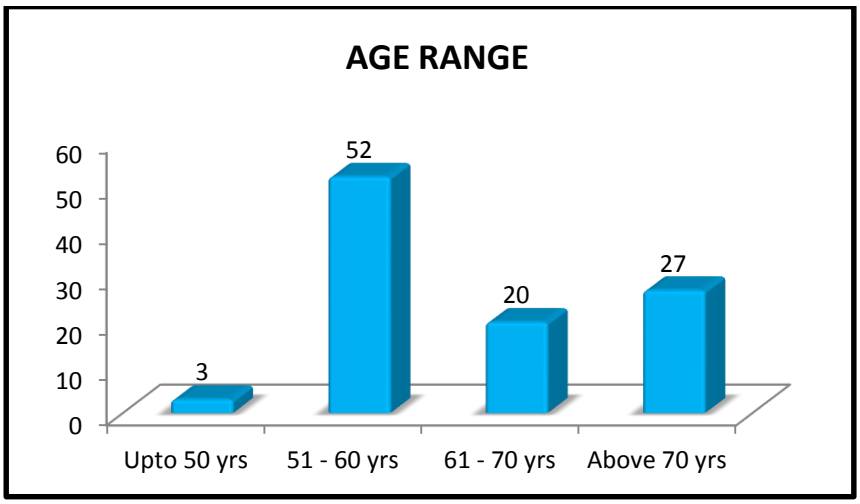
Table2 : Age Range

Age range

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Upto 50 yrs	3	2.9	2.9	2.9
	51 - 60 yrs	52	51.0	51.0	53.9
	61 - 70 yrs	20	19.6	19.6	73.5
	Above 70 yrs	27	26.5	26.5	100.0
	Total	102	100.0	100.0	

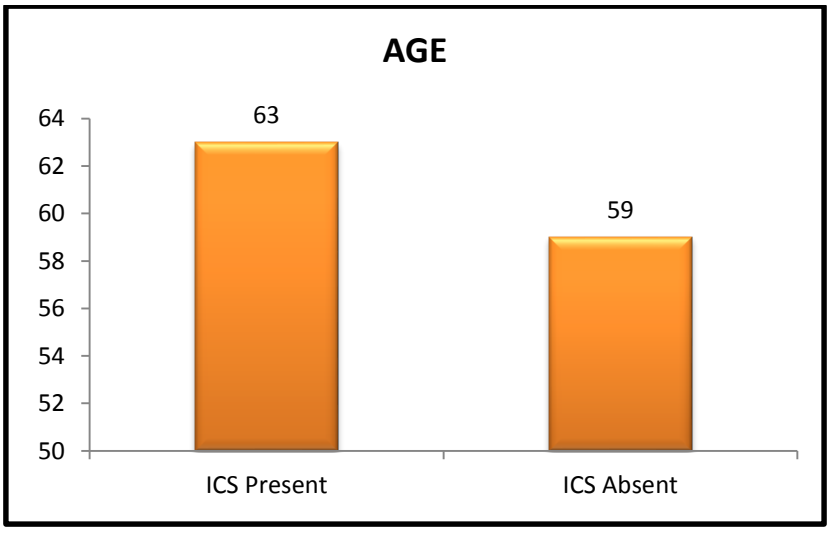
This above frequency table reveals that peak incidence of patients with intracranial stenosis is between 51-60 years and without intacranial stenosis is above 70 years& 51-60 years in my study

Figure 1: Age range Bar diagram



The above Bar diagram shows the age group incidence is more with 51-60 years of 52%

FIGURE 2: Mean Age Bar diagram



This above bar diagram shows the mean age which is maximum for patients with Intracranial stenosis of 63.

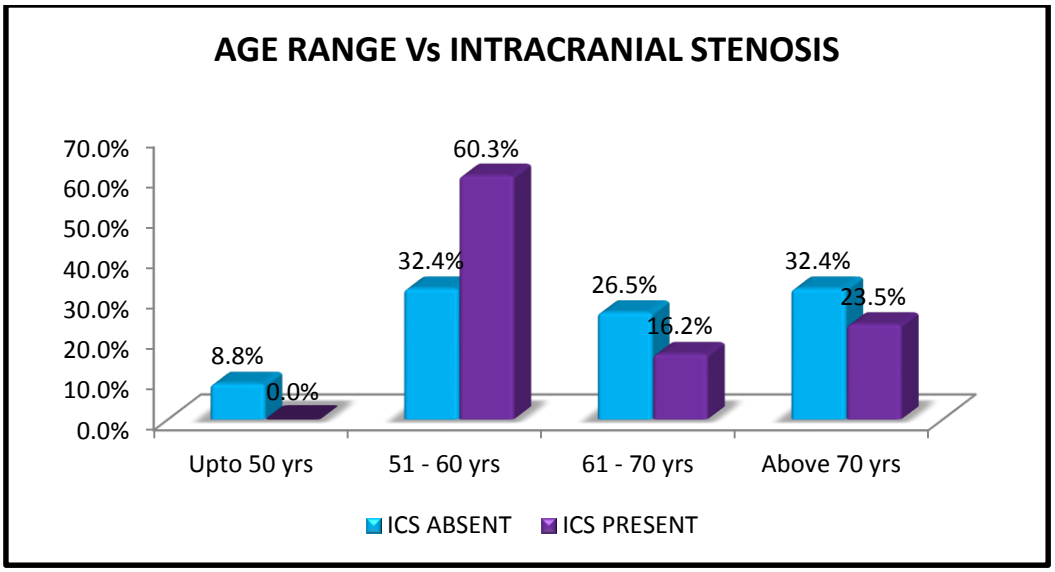
TABLE 3 : Chi-square tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.363[a]	3	.010
Likelihood Ratio	12.162	3	.007
Linear-by-Linear Association	1.026	1	.311
N of Valid Cases	102		

The above Chi square tests reveal that pearsonchi-square value is 11.363 with a degree of freedom of 3 and p value of p-0.010

FIGURE 3: Age range vs intracranial stenosis Bar diagram



The above Bar diagram shows the incidence of intracranial stenosis in CVA with respect to age group with maximum incidence being between 51-60 years.

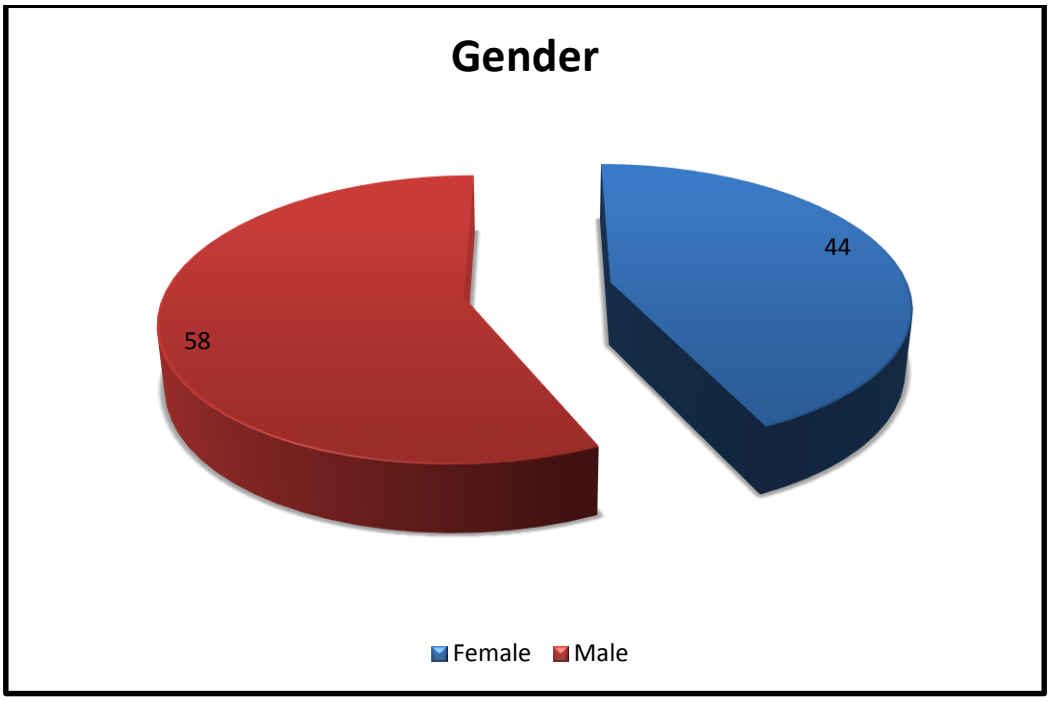
Sex Distribution

Among these 102 patients studied, male patients were 58 in number(56.9%) of the study and female subjects were 46(43.1% of the study). Among the study patients, there was no statistically significant difference in relation to gender status majority are males 56.9%

Table 4: Sex distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	44	43.1	43.1	43.1
	Male	58	56.9	56.9	100.0
	Total	102	100.0	100.0	

FIGURE4 : Gender Distribution in Pie chart



The above Pie chart shows that in my study the majority of subjects were Male of 58 patients with CVA.

HYPERTENSION

Among the study patients, hypertension was present in about 49 Subjects of CVA of 48% and in subjects with ICS, 61.8% of subjects had hypertension .Hypertension –ICS category was analysed using chi-square test and pearsonchi-square value is 15.396and degree of freedom is 1 and p value comes around p-0.000 ($p< 0.05$) which is statistically significant.

Table 5 : Frequency of hypertension

HYPERTENSION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ABSENT	53	52.0	52.0	52.0
	PRESENT	49	48.0	48.0	100.0
	Total	102	100.0	100.0	

The above table showing the frequency and percentage of Hypertension in my study group

Figure 5: Bar diagram With Hypertension

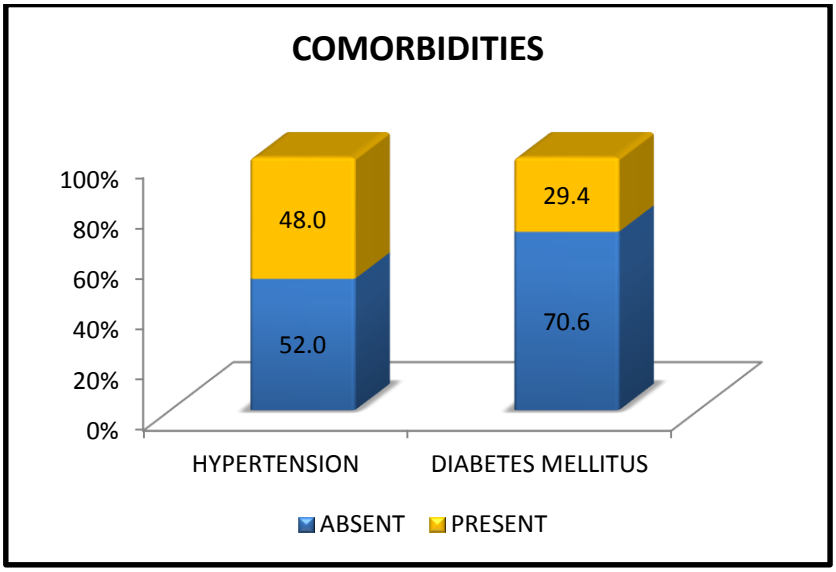


Table 6 : HYPERTENSION Vs ICS

Crosstab

			ICS		
			Absent	Present	Total
HYPERTENSION	ABSENT	Count	27	26	53
		% within ICS	79.4%	38.2%	52.0%
	PRESENT	Count	7	42	49
		% within ICS	20.6%	61.8%	48.0%
Total		Count	34	68	102
		% within ICS	100.0%	100.0%	100.0%

Table 7 : Chi- Square Tests

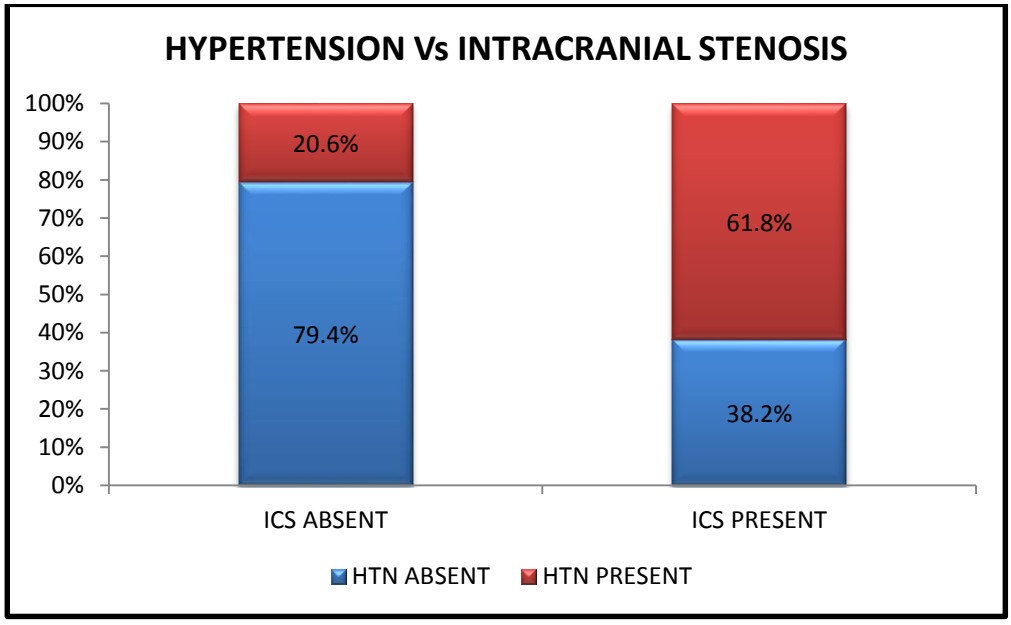
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square.	15.396[a]	1	.000		
Continuity Correction[b]	13.791	1	.000		
Likelihood Ratio.	16.203	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	102				

a. 0 cells (0.0%) have the expected count less than 5. The minimum expected count is 16.33.

b. Computed only for a 2x2 table

Figure 6 : Bar diagram for Hypertension VsIntacranial stenosis



Chaturvedi S et al, reported that elevated blood pressure and cholesterol levels in symptomatic patients with intracranial stenosis are associated with an increased risk of stroke and other major vascular events which has been also showed in my study with significant association with hypertension

Turan TN et al , reported In patients with intracranial stenosis, higher blood pressure is associated with increased (not decreased) risk of ischemic stroke and stroke in the territory of the stenotic vessel. which has been also showed in my study with significant association with hypertension

Rizaldy Pinzon etal,reported that Intracranial stenosis is present in more than one third of ischemic stroke patients. Hypertension and diabetes are significantly more prevalent in intracranial stenosis.which has been also showed in my study with significant association with hypertension

DIABETES MELLITUS

Among the study patients of 102, Diabetes was present in 30 subjects in which 28 diabetic patients had intracranial stenosis accounting for 41.2% .Diabetes –ICS category was analysed using chi-square test,Fisher's Exact Test and pearsonchi-square value is $13.600^{a}$and degree of freedom is 1 and p value comes around p-0.000 ($p< 0.05$) which is statistically significant

Table 8 : Frequency Of Diabetes Mellitus

DIABETESMELLITUS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ABSENT	72	70.6	70.6	70.6
	PRESENT	30	29.4	29.4	100.0
	Total	102	100.0	100.0	

The above table showing the frequency and percentage of Diabetes in my study group

Figure 7 : BarDiagram showing Diabetes and Hypertension

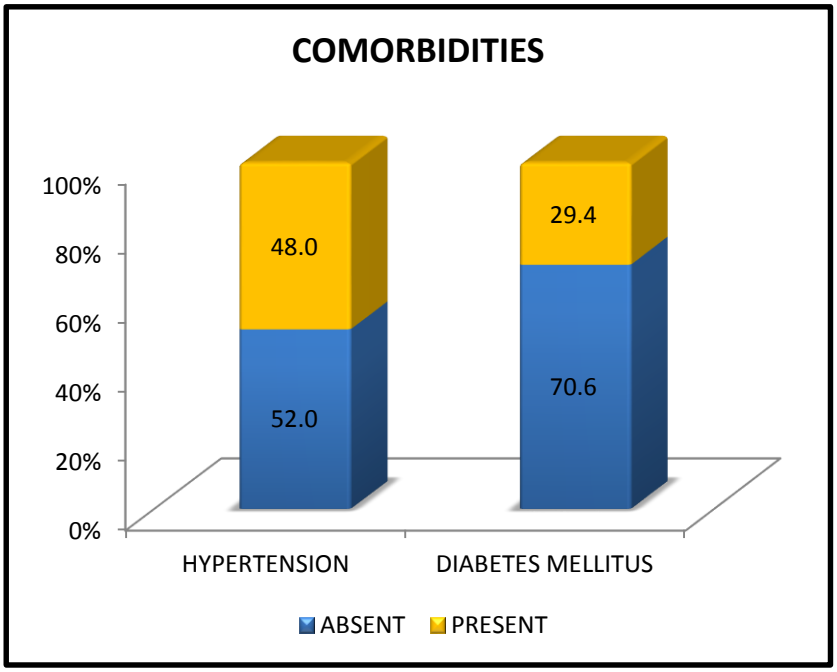


Table 9 :DIABETESMELLITUS VS ICS

Crosstab

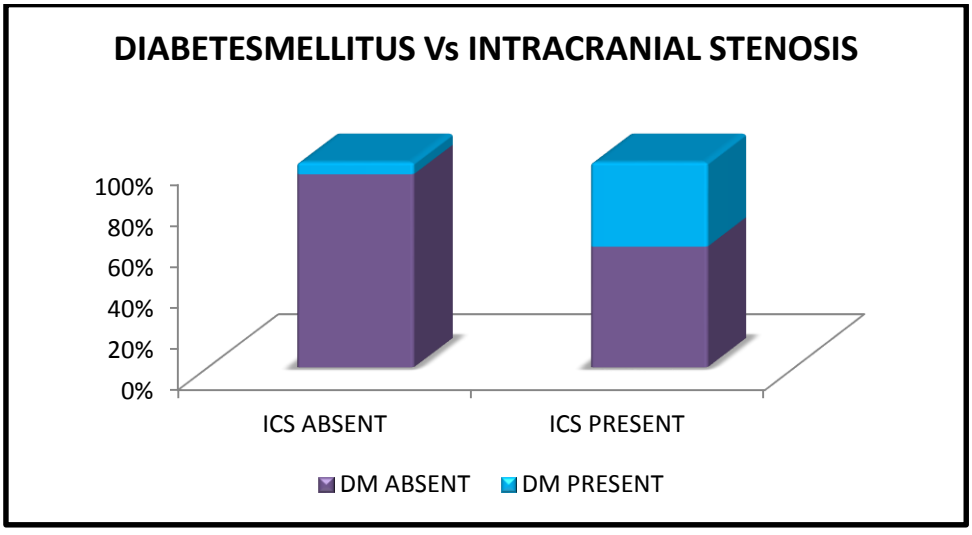
			ICS		Total
			Absent	Present	
DIABETESMELLITUS	ABSENT	Count	32	40	72
		% within ICS	94.1%	58.8%	70.6%
	PRESENT	Count	2	28	30
		% within ICS	5.9%	41.2%	29.4%
Total		Count	34	68	102
		% within ICS	100.0%	100.0%	100.0%

Table 10 : Chi Square Tests

Chi-Square Tests

	Value	df	Asymp. Sig. 2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square.	13.600[a]	1	.000		
Continuity Correction[b]	11.953	1	.001		
Likelihood Ratio.	16.231	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	102				

Figure 8 : Bar diagram of Diabetes mellitus Vs Intracranial stenosis



Mendes I et al reported that Diabetes mellitus is an important independent risk factor of alterations in the intracranial blood vessels and therefore of CVA. The intracranial circulation should be studied in these patients in view of the great frequency of intracranial stenoses and possible future improvements with therapeutic intervention.which has been also showed in my study with significant association with diabetes mellitus

Sacco RL et al reported the greater prevalence of diabetes and hypercholesterolemia among blacks and Hispanics from northern Manhattan accounted for much of the increased frequency of intracranial atherosclerotic stroke. Further control of these risk factors could reduce the frequency of this stroke subtype and minimize the disparities among different race-ethnic groups. which has been also showed in my study with significant association with diabetes mellitus

Do-Hyung Kim et al reported Diabetes mellitus may be associated with the development of intracranial atherosclerosis, which is predominant in stroke patients which has been also showed in my study with significant association with diabetes mellitus.

ALCOHOL

Among the study patients of 102, Alcohol was being consumed by 31 subjects in which 14 alcohol consumption subjects had intracranial stenosis accounting for 20.6% .

Alcohol–ICS category was analysed using chi-square test, and pearson chi-square value is 9.269^{a} and degree of freedom is 1 and p value comes around p-0.002 ($p< 0.05$) which is statistically significant

Table 11 : Frequency of subjects with Alcoholism

ALCOHOL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	71	69.6	69.6	69.6
	YES	31	30.4	30.4	100.0
	Total	102	100.0	100.0	

Figure 9 : Bar diagram of Alcoholics

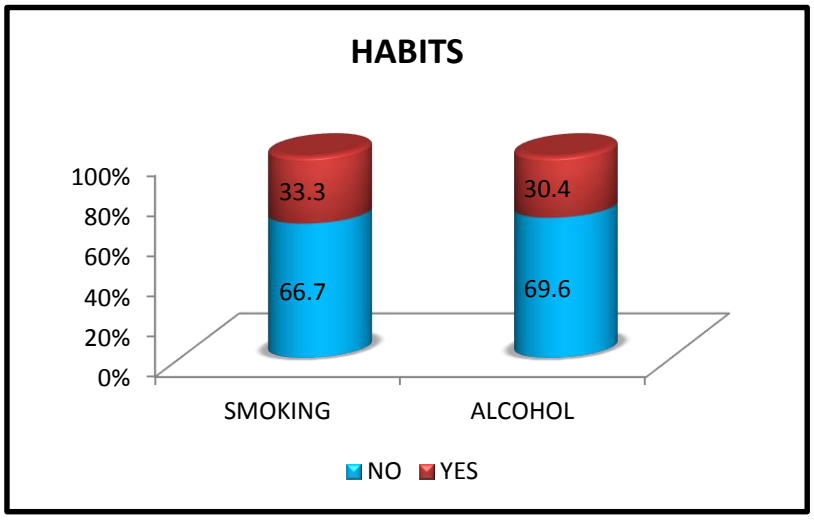


Table 12 : ALCOHOL Vs ICS

Crosstab

			ICS		Total
			Absent	Present	
ALCOHOL	NO	Count	17	54	71
		% within ICS	50.0%	79.4%	69.6%
	YES	Count	17	14	31
		% within ICS	50.0%	20.6%	30.4%
Total		Count	34	68	102
		% within ICS	100.0%	100.0%	100.0%

Table 13 : Chi Square Tests

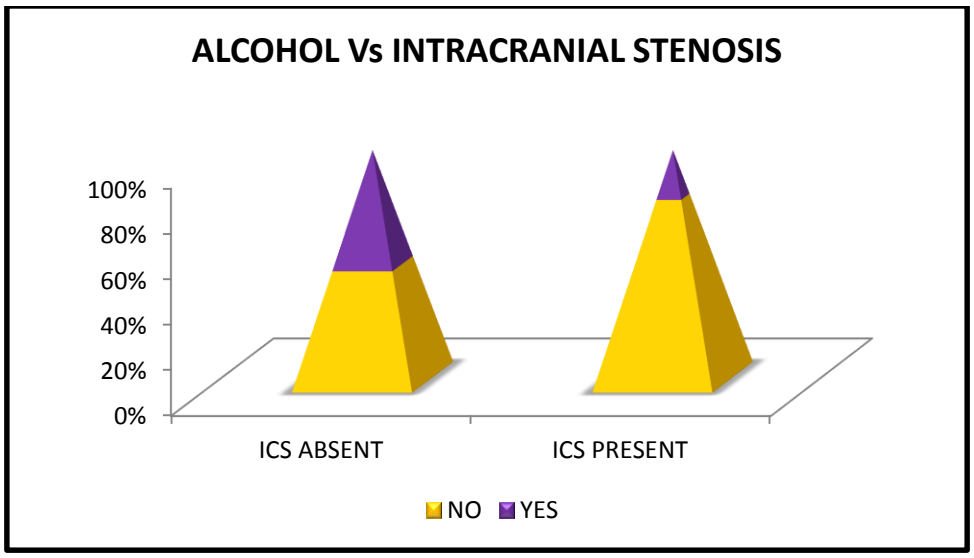
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square.	9.269[a]	1	.002		
Continuity Correction[b]	7.930	1	.005		
Likelihood Ratio.	9.004	1	.003		
Fisher's Exact Test				.003	.003
N of Valid Cases	102				

a. 0 cells (0.0%) have the expected count less than 5. The minimum expected count is 10.33.

b. Computed only for a 2x2 table

Figure 10 : Cone Pictogram of Alcohol Vs Intracranial stenosis



AdriàArboix et al reported that chronic heavy alcohol consumption (> 60 g/d) is associated with an increase in the relative risk of stroke.In my study there was significant association of CVA with Alcoholics

SMOKING

Among the study patients of 102, Smokers were 34 subjects in which 16 smokers subjects had intracranial stenosis accounting for 23.5% .

Smoking–ICS category was analysed using chi-square test, and pearsonchi-square value is 8.824[a] and degree of freedom is 1 and p value comes around p-0.003 ($p < 0.05$) which is statistically significant

Table 14 : Frequency of Smokers

SMOKING

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	68	66.7	66.7	66.7
	YES	34	33.3	33.3	100.0
	Total	102	100.0	100.0	

Figure 11 : Bar diagram of Smokers and Alcoholics

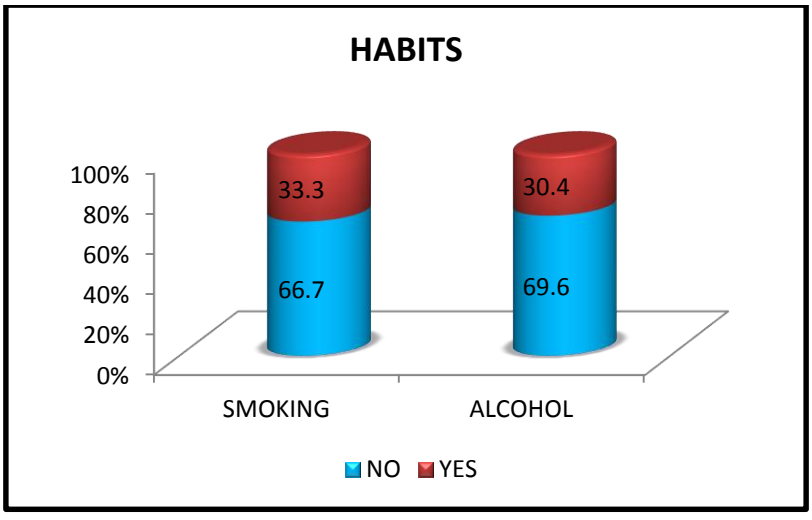


Table 15 : SMOKING Vs ICS

Crosstab

			ICS		Total
			Absent	Present	
SMOKING	NO	Count	16	52	68
		% within ICS	47.1%	76.5%	66.7%
	YES	Count	18	16	34
		% within ICS	52.9%	23.5%	33.3%
Total		Count	34	68	102
		% within ICS	100.0%	100.0%	100.0%

Table 16 : Chi Square Tests

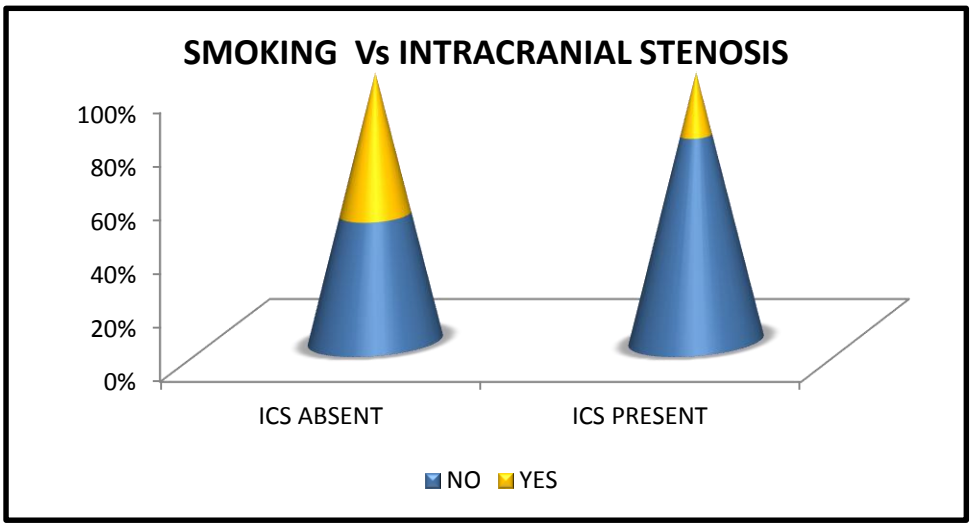
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.824[a]	1	.003		
Continuity Correction[b]	7.550	1	.006		
Likelihood Ratio	8.632	1	.003		
Fisher's Exact Test				.004	.003
N of Valid Cases	102				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.33.

b. Computed only for a 2x2 table

Figure 12 : Cone diagram of Smoking Vs Intracranial Stenosis



ManasGhosh et al, reported that Smoking is an important risk factor for Atherosclerotic stenosis,which has been shown in our study that smoking was an independent risk factor

Xin Ding et al reported that Smoking is an important risk factor for extracranialstenosis,which has been shown in our study that smoking was an independent risk factor for patients without intracranial stenosis

AORTIC KNOB CALCIFICATION

Among the study patients of 102 Aortic knob calcification was present in 32 subjects accounting for 31.4% .In Aortic Knob Calcification vsICS, Aortic knob calcification was present in 22 subjects of Intracranial stenosis subjects accounting to 32.4%

Aortic Knob Calcification –ICS category was analysed using chi-square test, Fisher's Exact Test and pearsonchi-square, Among the study patients, there was no statistically significant difference

TABLE 18 Shows association and comparison of Aortic knob calcification subjects which was 32 with Intracranial stenosis, In which out of 32 Aortic knob calcification subjects, 22 patient had Intracranial stenosis. Accounting for 69% association of Aortic Knob calcification with Intra cranial stenosis and 31% without intracranial stenosis .Hence Subject with Aortic knob Calcification had 69% significant association of Intracranial stenosis

Table 17 : Frequency of Aortic Knob Calcification

AORTIC KNOB CALCIFICATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ABSENT	70	68.6	68.6	68.6
	PRESENT	32	31.4	31.4	100.0
	Total	102	100.0	100.0	

Figure 13 : Bar diagram of Aortic Knob Calcification

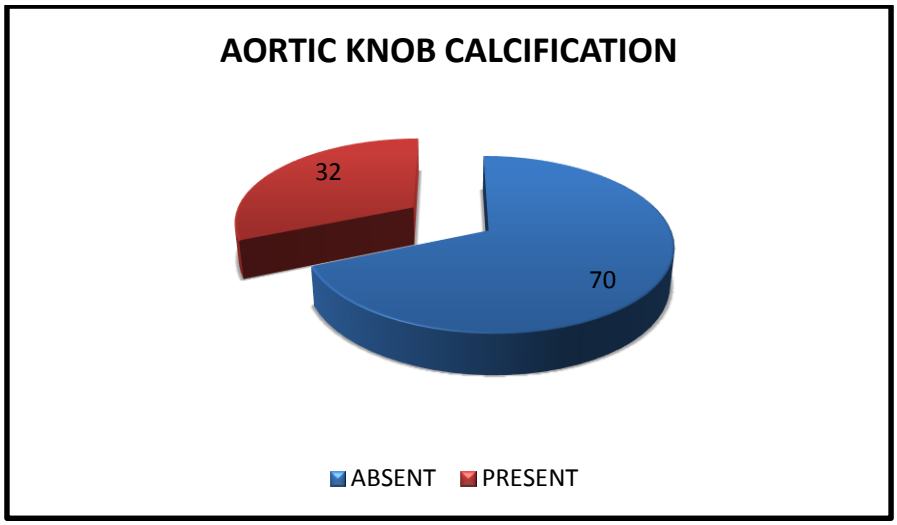


Table 18 : Aortic Knob Calcification Vs ICS

Crosstab

			ICS		Total
			Absent	Present	
AORTIC KNOB CALCIFICATION	ABSENT	Count	24	46	70
		% within ICS	70.6%	67.6%	68.6%
	PRESENT	Count	10	22	32
		% within ICS	29.4%	32.4%	31.4%
Total		Count	34	68	102
		% within ICS	100.0%	100.0%	100.0%

Table 19 : Chi Square Tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.091[a]	1	.763		
Continuity Correction[b]	.006	1	.940		
Likelihood Ratio	.092	1	.762		
Fisher's Exact Test				.824	.474
N of Valid Cases	102				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.67.

b. Computed only for a 2x2 table

Figure 14 : Bar Diagram Aortic Knob Calcification Vs Intracranial Stenosis

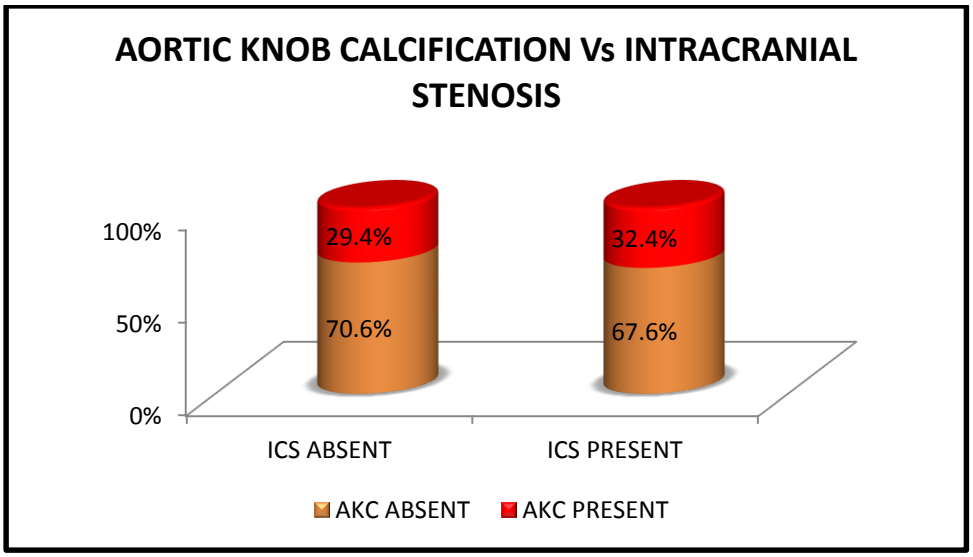
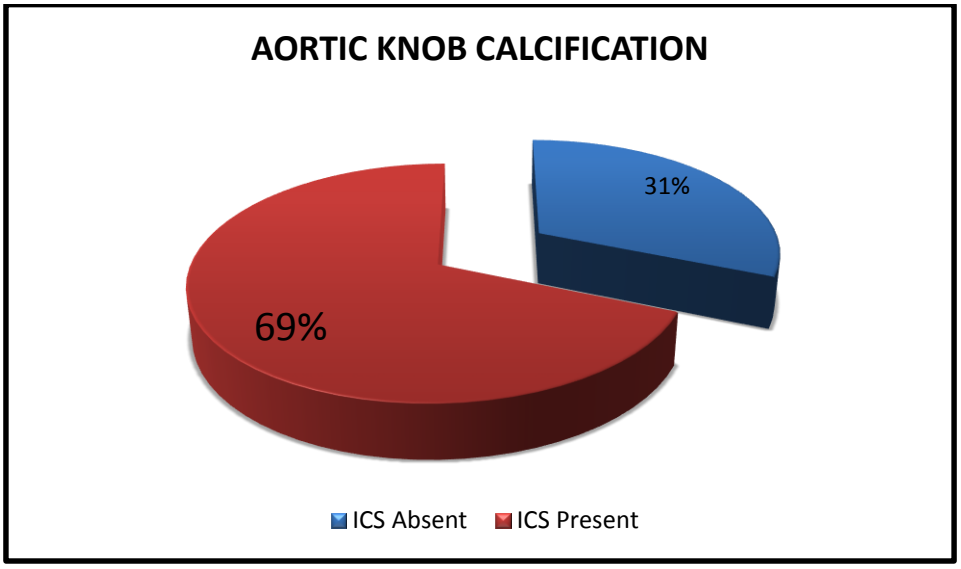


Table 20 : In AC Patients with IC stenosis and without IC stenosis

AORTIC KNOB CALCIFICATION		
ICS Absent	10	31%
ICS Present	22	69%
Total	32	100%

Figure 15 : Bar diagram of AC Patients with IC stenosis and without IC stenosis



Young Seo Kim et al, reported Aortic knob calcification appears to be a reliable predictor for Intra cranial stenosis, an important mechanism of ischemic stroke, in our study also showed positive association of AC with IC Stenosis

Tae-Jin Song et al, reported positive relationship with systemic atherosclerosis and coexisting cerebral SVDs in acute ischemic stroke patientsin our study also showed positive association of AC with ischemic stroke patients.

LIPID PROFILE

Among the study patients of 102 Ischemic stroke the mean cholesterol value for patients with intracranial stenosis and without intracranial stenosis were 188.06 and190.97 respectively

Mean TGL value were 111.01 and 111.50, Mean HDL value were 44.28 and 44.65, Mean LDL Value were114.59 and 109.97 for subjects with intracranial stenosis and without intracranial stenosis respectively

Lipid Profile–ICS category was analysed using chi-square test,Fisher's Exact Test and pearsonchi-square, Among the study patients, there was no statistically significant difference found in subjects with intracranial stenosis and without intracranial stenosis

Table 21 :Group statistics Of Lipid Profile

Group Statistics

ICS		N	Mean	Std. Deviation	Std. Error Mean
AGE	Present	68	62.97	5.585	.677
	Absent	34	59.32	7.100	1.218
TOTALCHOLESTROL	Present	68	188.06	16.348	1.982
	Absent	34	190.97	19.113	3.278
TGL	Present	68	111.01	26.184	3.175
	Absent	34	111.50	27.743	4.758
HDL	Present	68	44.28	8.496	1.030
	Absent	34	44.65	8.900	1.526
LDL	Present	68	114.59	17.535	2.126
	Absent	34	109.97	17.412	2.986

Table 22 :T-Test

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
AGE	.954	.331	2.834	100	.006	3.647	1.287	1.094	6.200
TOTALCHOLESTROL	.204	.652	-.801	100	.425	-2.912	3.636	-10.125	4.301
TGL	.010	.920	-.087	100	.931	-.485	5.610	-11.615	10.645
HDL	.335	.564	-.203	100	.840	-.368	1.813	-3.964	3.229
LDL	.206	.651	1.257	100	.212	4.618	3.675	-2.673	11.908

Figures16 :-Lipid profile values in patient with intracranial stenosis and without intracranial stenosis

Figure 16 a : Age Bar diagram

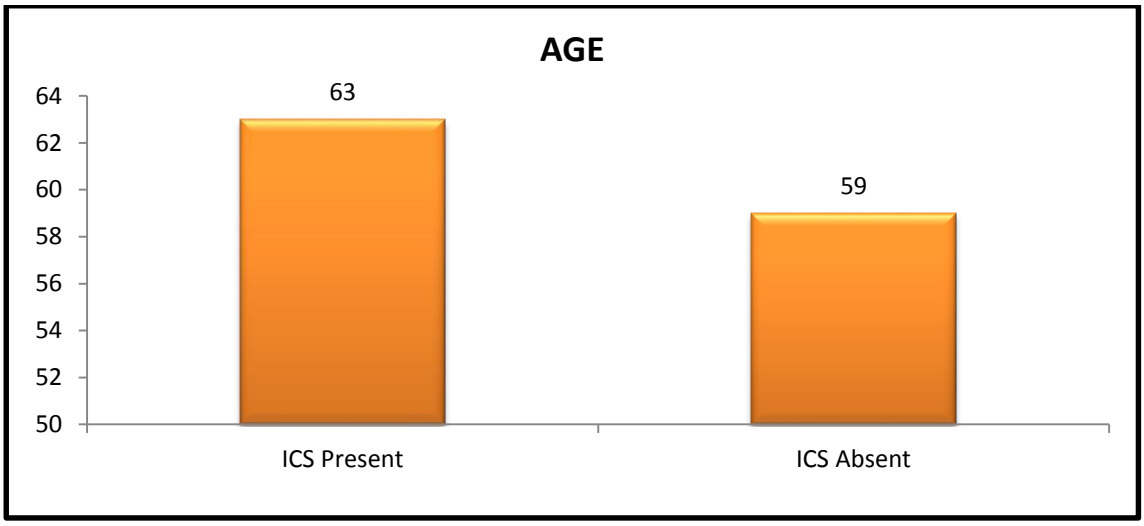


Figure 16 b :Total cholesterol Bar diagram

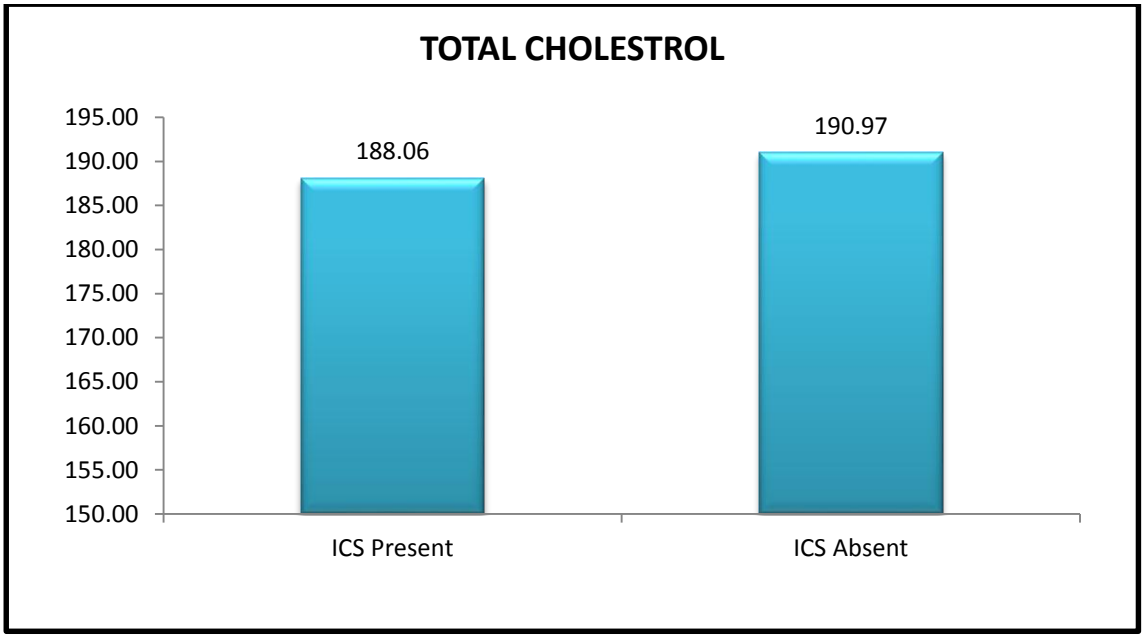


Figure 16 c : TGL Bar diagram

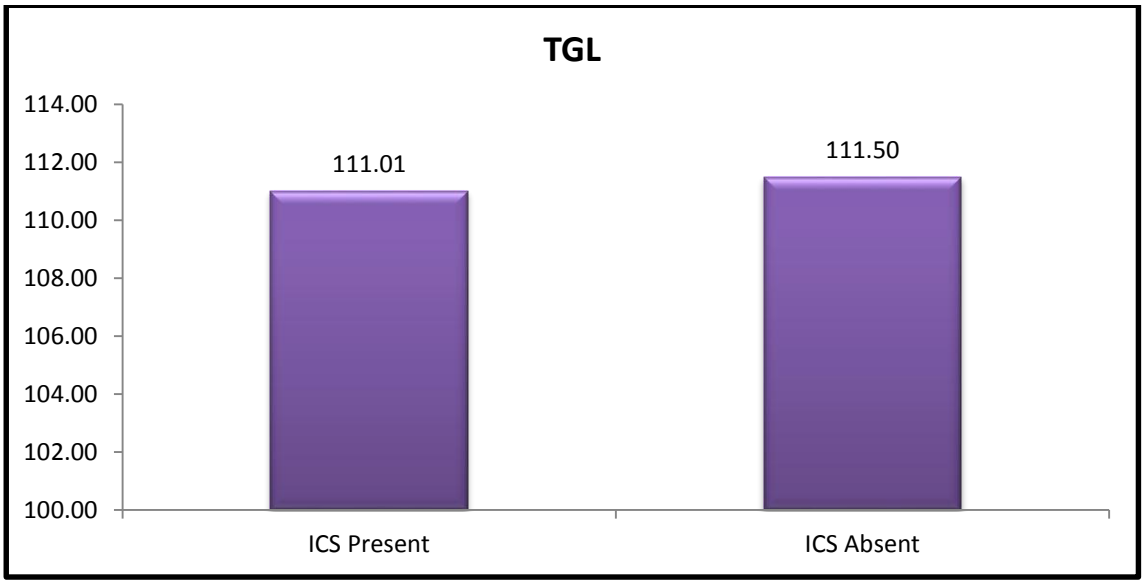


Figure 16 d : HDL Bar diagram

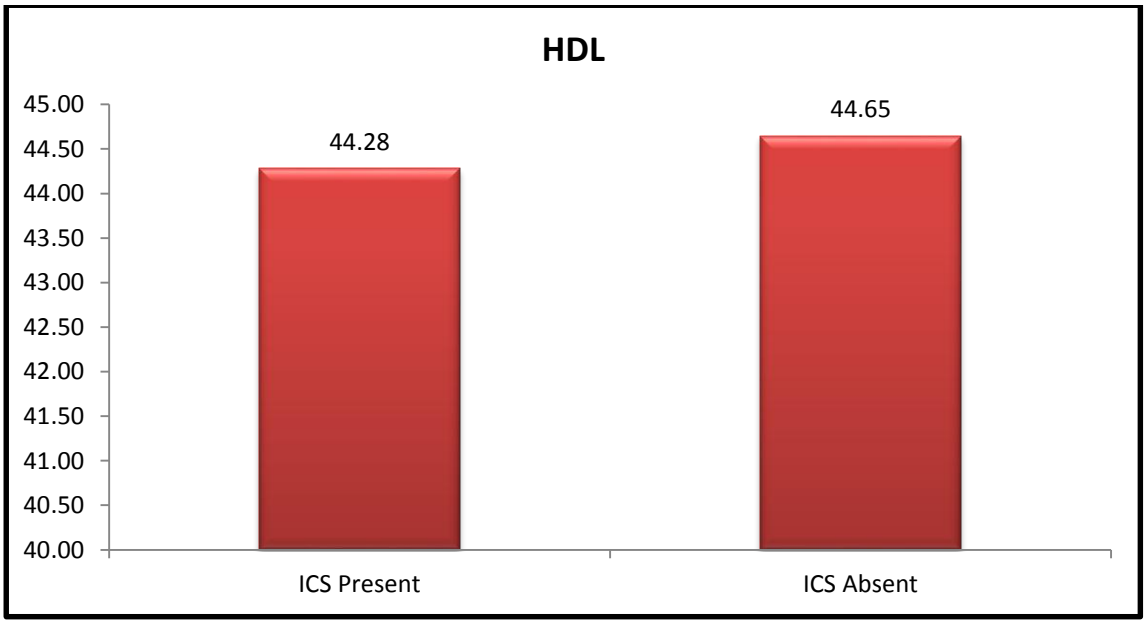
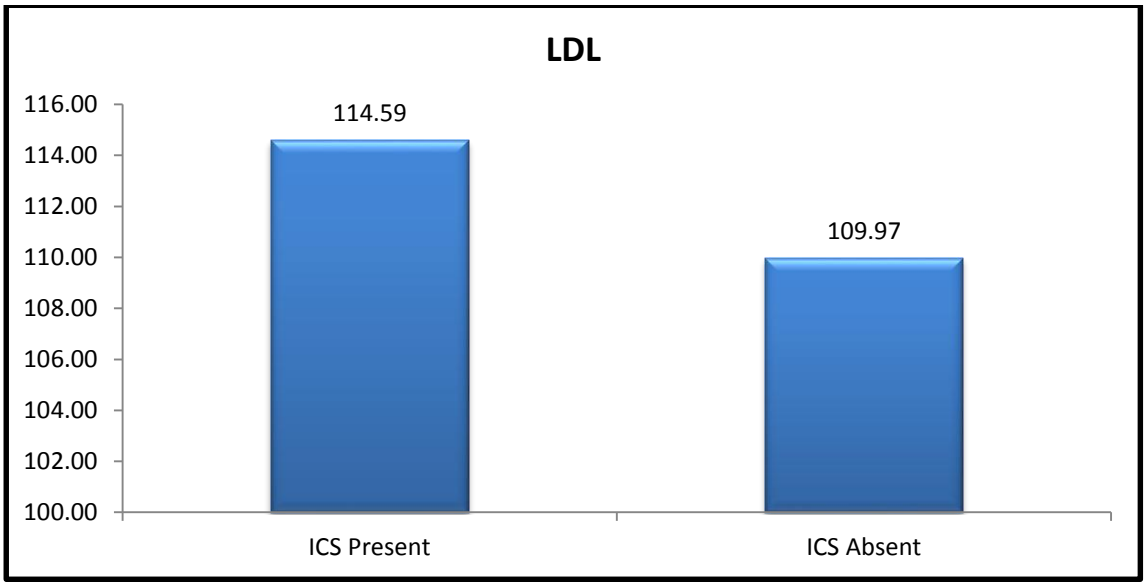


Figure 16 e :LDL Bar diagram



In my study there was no statistically significant difference found in subjects with intracranial stenosis and without intracranial stenosis in Relation to Lipid profiles of the patients.

CONCLUSION

1. In my study patients with intracranial stenosis and without intracranial stenosis were compared and studied
2. There was significant association between increased age and subjects with intracranial stenosis
3. There was significant association between diabetes and subjects with Intracranial stenosis
4. There was significant association between Hypertension and subjects with Intracranial stenosis
5. There was significant association between Smoking and subjects with Intracranial stenosis
6. There was significant association between Alcohol and subjects with Intracranial stenosis
7. There was no significant association between Lipid profile Total cholesterol, TGL, HDL, LDL and subjects with Intracranial stenosis
8. There was significant association between Aortic knob stenosis and Intracranial stenosis when compared to patients without intracranial stenosis of 69%, signifying the importance of simple Chest Radiography in prediction of CVA

In conclusion, my results suggest that Aortic knob calcification is a reliable predictor for Intra cranial stenosis in ischemic stroke patients. An increase in the use of chest radiography as a screening or risk factor assessment tool may be justified, as AC has a strong specificity for infarcts that may enable a clinician to start medical management on asymptomatic atherosclerosis so as to prevent Cerebrovascular events and also improve the subject outcome;still larger studies are needed in this area as it is first study in our population,to become it generalize

PROFORMA

Name: Age/sex:

Address: IPNO:

DM – Yes/No

Diagnosis:

QUESTIONNAIRE:

Diabetes

Hypertension

Cigaratte Smoking

Alcohol

Drugs/ Details of the drug if any

INVESTIGATIONS:

Complete blood count

Renal function tests

Liver function tests

Lipid profile – Triglycerides, LDL,HDL and Total Cholestrol

Blood Sugar

Chest Radiograph (Postero anterior view)

MRI Brain Angiography

PATIENT CONSENT FORM

Study detail: **"Association of Aortic Knob Calcification with Intracranial Stenosis in Ischemic Stroke Patients in tertiary care centre ."**

Study centre : ROYAPETTAH HOSPITAL/ KILPAUK MEDICAL COLLEGE, CHENNAI

Patients Name :

Patients Age :

Identification Number :

Patient may check (✓) these boxes

I confirm, that I have understood the purpose of procedure for the above study. I have the opportunity to ask question in this study and all my questions and doubts have been answered to my complete satisfaction. ☐

I understand that my participation in this study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ☐

I understand that sponsor of the clinical study, others working on behalf of the sponsor behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the court of law. I agree not to restrict the use of any data or results that arise from this study. ☐

I agree to take part in the above mentioned study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well-being or any unexpected or unusual symptoms. ☐

I hereby consent to participate in this study. ☐

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests. ☐

Signature/thumb impression:

Patients Name and Address: place date

Signature of investigator :

Study investigator's Name : place date

சுய ஒப்புதல் படிவம்

ஆய்வு செய்யப்படும் தலைப்பு: "Association of Aortic Knob Calcification with Intracranial Stenosis in Ischemic Stroke Patients in tertiary care centre."

இடம்: பொது மருத்துவத்துவதுரைஅ ரசுகீழ்பாக்கம் மருத்துவகல்லூரி மருத்துவமனை,ராயப்பேட்டை மருத்துவமனை,சென்னை -10

பங்குபெறுபவரின்பெயர் :

பங்கு பெறுபவரின் வயது : பங்கு பெறுபவரின் எண் :

மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. நான் இவ்வாய்வில் தன்னிச்சையாக பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த சட்டசிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகிக் கொள்ளல்லாம் என்றும் அறிந்து கொண்டேன்.

இந்த ஆய்வு சம்பந்தமாகவோ, இதைசார்ந்து மேலும் ஆய்வு மேற்கொள்ளும் போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். இந்த ஆய்வின் மூலம் கிடைக்கும் தகவலையோ, முடிவையோ பயன்படுத்திக் கொள்ள மறுக்க மாட்டேன்.

இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக் கொள்கிறேன். இந்த ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்றும் உறுதியளிக்கிறேன்.

பங்கேற்பவரின் கையொப்பம்:

ஆய்வாளரின் கையொப்பம்:

இடம் :

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MASTER CHART

	AGE	SEX	HYPERTENSION	DIABETES MELLITUS	TOTAL CHOLESTROL	TGL	HDL	LDL	AORTIC KNOB CALCIFICATION	INTRACRANIAL STENOSIS	SMOKING	ALCOHOL
1	62	M	PRESENT	PRESENT	149	78	32	96	PRESENT	NO	YES	YES
2	65	F	PRESENT	ABSENT	145	80	31	121	PRESENT	PRESENT	NO	NO
3	70	M	PRESENT	ABSENT	201	120	28	130	PRESENT	PRESENT	YES	NO
4	72	M	PRESENT	ABSENT	212	112	35	112	PRESENT	PRESENT	YES	NO
5	55	M	ABSENT	ABSENT	190	110	48	104	ABSENT	NO	YES	YES
6	58	F	ABSENT	PRESENT	160	90	52	89	ABSENT	PRESENT	NO	NO
7	64	F	PRESENT	PRESENT	150	82	55	98	ABSENT	PRESENT	NO	NO
8	54	M	ABSENT	ABSENT	211	100	53	106	ABSENT	NO	YES	YES
9	58	F	ABSENT	ABSENT	180	106	49	158	ABSENT	PRESENT	NO	NO
10	72	F	ABSENT	ABSENT	190	98	62	142	ABSENT	PRESENT	NO	NO
11	70	F	ABSENT	ABSENT	210	84	60	135	ABSENT	PRESENT	NO	NO
12	54	M	ABSENT	ABSENT	200	74	54	128	ABSENT	PRESENT	YES	NO
13	62	F	ABSENT	ABSENT	188	96	49	98	ABSENT	NO	NO	NO
14	65	F	ABSENT	ABSENT	186	106	48	88	ABSENT	NO	NO	NO
15	55	M	PRESENT	PRESENT	214	120	47	100	ABSENT	PRESENT	YES	YES
16	48	M	ABSENT	ABSENT	190	108	60	114	ABSENT	NO	NO	YES
17	52	F	PRESENT	ABSENT	210	150	52	159	ABSENT	PRESENT	YES	YES
18	56	M	ABSENT	ABSENT	190	88	51	162	ABSENT	NO	YES	YES
19	70	F	PRESENT	ABSENT	168	84	36	130	PRESENT	PRESENT	NO	NO
20	61	M	ABSENT	ABSENT	221	94	45	120	ABSENT	NO	YES	NO
21	62	M	PRESENT	PRESENT	158	168	40	112	PRESENT	PRESENT	NO	YES
22	59	M	ABSENT	PRESENT	196	174	44	131	ABSENT	PRESENT	NO	YES
23	60	M	PRESENT	ABSENT	176	198	50	101	PRESENT	NO	NO	YES
24	65	F	ABSENT	ABSENT	189	80	50	152	ABSENT	PRESENT	NO	NO
25	69	M	PRESENT	PRESENT	192	82	42	111	PRESENT	PRESENT	NO	NO
26	55	M	ABSENT	ABSENT	206	148	38	131	ABSENT	NO	YES	YES
27	63	F	ABSENT	PRESENT	199	130	39	120	ABSENT	PRESENT	NO	NO
28	54	F	PRESENT	PRESENT	177	94	40	102	ABSENT	PRESENT	NO	NO
29	57	M	ABSENT	ABSENT	203	98	42	108	ABSENT	NO	YES	YES
30	61	M	PRESENT	ABSENT	166	112	46	114	PRESENT	PRESENT	NO	NO
31	76	F	ABSENT	ABSENT	159	68	34	98	PRESENT	NO	NO	NO
32	62	M	PRESENT	ABSENT	182	108	54	106	ABSENT	PRESENT	NO	NO
33	63	F	PRESENT	ABSENT	189	124	32	89	ABSENT	NO	NO	NO
34	60	M	ABSENT	PRESENT	193	96	42	94	ABSENT	PRESENT	YES	NO
35	70	F	PRESENT	ABSENT	181	84	40	119	PRESENT	PRESENT	NO	NO
36	65	M	ABSENT	ABSENT	223	82	41	137	PRESENT	PRESENT	NO	NO
37	59	F	ABSENT	ABSENT	200	138	58	148	PRESENT	NO	NO	NO
38	61	M	PRESENT	PRESENT	188	148	46	150	ABSENT	PRESENT	NO	YES
39	55	M	PRESENT	PRESENT	198	104	34	101	ABSENT	PRESENT	YES	YES
40	51	F	ABSENT	ABSENT	223	116	52	95	ABSENT	NO	NO	NO
41	65	M	PRESENT	ABSENT	186	132	48	92	ABSENT	PRESENT	NO	NO
42	60	M	ABSENT	ABSENT	206	144	36	85	ABSENT	PRESENT	YES	YES
43	70	F	ABSENT	PRESENT	192	158	39	105	PRESENT	PRESENT	NO	NO
44	71	M	PRESENT	ABSENT	207	100	54	120	ABSENT	NO	YES	NO
45	62	M	PRESENT	PRESENT	168	103	30	118	PRESENT	PRESENT	NO	NO
46	68	M	ABSENT	ABSENT	172	89	42	139	ABSENT	PRESENT	NO	NO
47	67	M	PRESENT	PRESENT	185	92	38	147	ABSENT	PRESENT	NO	NO
48	61	F	PRESENT	ABSENT	201	82	56	105	ABSENT	PRESENT	NO	NO
49	63	F	ABSENT	ABSENT	222	76	40	114	PRESENT	NO	NO	NO
50	55	F	PRESENT	ABSENT	183	128	45	138	ABSENT	PRESENT	NO	NO
51	59	M	ABSENT	ABSENT	188	136	35	104	ABSENT	NO	YES	YES

52	62	M	ABSENT	ABSENT	203	152	53	132	ABSENT	PRESENT	YES	NO
53	62	M	PRESENT	ABSENT	175	114	41	100	ABSENT	PRESENT	NO	NO
54	76	F	ABSENT	ABSENT	169	88	33	103	PRESENT	NO	NO	NO
55	60	M	PRESENT	ABSENT	197	96	45	92	PRESENT	PRESENT	NO	NO
56	57	M	ABSENT	ABSENT	185	116	39	128	ABSENT	NO	YES	YES
57	54	F	PRESENT	PRESENT	173	124	57	114	ABSENT	PRESENT	NO	NO
58	63	F	ABSENT	PRESENT	201	82	45	96	ABSENT	PRESENT	NO	NO
59	55	M	ABSENT	ABSENT	205	128	33	116	ABSENT	NO	YES	YES
60	69	M	PRESENT	PRESENT	203	96	41	96	PRESENT	PRESENT	NO	NO
61	65	F	ABSENT	ABSENT	196	89	55	89	ABSENT	PRESENT	NO	NO
62	60	M	PRESENT	ABSENT	195	132	49	95	PRESENT	NO	NO	YES
63	59	M	ABSENT	PRESENT	184	148	43	117	ABSENT	PRESENT	NO	YES
64	62	M	PRESENT	PRESENT	178	152	39	122	PRESENT	PRESENT	NO	YES
65	61	M	ABSENT	ABSENT	220	158	31	91	ABSENT	NO	YES	NO
66	70	F	PRESENT	ABSENT	169	95	35	111	PRESENT	PRESENT	NO	NO
67	56	M	ABSENT	ABSENT	189	84	59	99	ABSENT	NO	YES	YES
68	52	F	PRESENT	ABSENT	209	73	47	108	ABSENT	PRESENT	YES	YES
69	48	M	ABSENT	ABSENT	170	87	35	120	ABSENT	NO	NO	YES
70	55	M	PRESENT	PRESENT	213	117	53	112	ABSENT	PRESENT	YES	YES
71	65	F	ABSENT	ABSENT	175	125	45	110	ABSENT	NO	NO	NO
72	63	F	ABSENT	ABSENT	183	156	39	90	ABSENT	PRESENT	NO	NO
73	45	M	ABSENT	ABSENT	191	122	51	100	ABSENT	NO	YES	NO
74	70	F	ABSENT	ABSENT	175	134	53	106	ABSENT	PRESENT	NO	NO
75	72	F	ABSENT	ABSENT	205	91	47	120	ABSENT	PRESENT	NO	NO
76	58	F	ABSENT	ABSENT	173	88	49	108	ABSENT	PRESENT	NO	NO
77	54	M	ABSENT	ABSENT	210	86	54	150	ABSENT	NO	YES	YES
78	64	F	PRESENT	PRESENT	181	140	46	94	ABSENT	PRESENT	NO	NO
79	58	F	ABSENT	PRESENT	197	79	56	94	ABSENT	PRESENT	NO	NO
80	55	M	ABSENT	ABSENT	189	85	48	112	ABSENT	NO	YES	YES
81	72	M	PRESENT	ABSENT	211	111	34	124	PRESENT	PRESENT	YES	NO
82	70	M	PRESENT	ABSENT	201	105	27	104	PRESENT	PRESENT	YES	NO
83	65	F	PRESENT	ABSENT	180	136	31	116	PRESENT	PRESENT	NO	NO
84	62	M	PRESENT	PRESENT	149	102	32	100	PRESENT	NO	YES	YES
85	55	F	PRESENT	ABSENT	203	99	55	103	ABSENT	PRESENT	NO	NO
86	63	F	ABSENT	ABSENT	175	154	39	114	PRESENT	NO	NO	NO
87	61	F	PRESENT	ABSENT	173	127	58	116	ABSENT	PRESENT	NO	NO
88	67	M	PRESENT	PRESENT	195	124	46	124	ABSENT	PRESENT	NO	NO
89	68	M	ABSENT	ABSENT	181	108	38	96	ABSENT	PRESENT	NO	NO
90	62	M	PRESENT	PRESENT	193	86	30	117	PRESENT	PRESENT	NO	NO
91	70	M	PRESENT	ABSENT	206	98	56	111	ABSENT	NO	YES	NO
92	71	F	ABSENT	PRESENT	177	122	39	105	PRESENT	PRESENT	NO	NO
93	60	M	ABSENT	ABSENT	167	142	48	102	ABSENT	PRESENT	YES	YES
94	65	M	PRESENT	ABSENT	193	137	39	108	ABSENT	PRESENT	NO	NO
95	54	F	ABSENT	ABSENT	182	106	48	98	ABSENT	NO	NO	NO
96	55	M	PRESENT	PRESENT	170	96	56	122	ABSENT	PRESENT	YES	YES
97	61	M	PRESENT	PRESENT	210	84	53	106	ABSENT	PRESENT	NO	YES
98	59	F	ABSENT	ABSENT	185	138	45	96	PRESENT	NO	NO	NO
99	65	M	PRESENT	ABSENT	194	148	40	116	PRESENT	PRESENT	NO	NO
100	70	F	PRESENT	ABSENT	179	116	39	104	PRESENT	PRESENT	NO	NO
101	60	M	ABSENT	PRESENT	192	88	32	128	ABSENT	PRESENT	YES	NO
102	63	F	PRESENT	ABSENT	179	104	49	120	ABSENT	PRESENT	NO	NO
	102 cases	44-F 68-M	49	30					32	68	34	31